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Disparities in the 2009 Swine Flu Pandemic and COVID-19: A Literature Review

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DISPARITIES IN THE 2009 SWINE FLU
PANDEMIC AND COVID-19: A LITERATURE REVIEW

by

YUSUF A. AMAWI

A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Health Services Administration
in the Department of Health Management and Informatics
in the College of Community Innovation and Education
and in the Burnett Honors College
at the University of Central Florida
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Abstract

The purpose of this thesis was to identify causes of disparities in affliction (infection) and mortality for minority populations (Blacks, Hispanics, Asians, and American Indian/Alaskan Natives) during the Swine Flu (H1N1) and COVID-19 (Sars-Cov-2) Pandemics. A literature review was conducted gathering peer-reviewed journal articles related to racial and socioeconomic disparities in affliction and mortality during both pandemics. The model of Blumenshine et al. (2008) was used as a guide for the analysis of this thesis, and measures of exposure, susceptibility, and treatment were hypothesized as causes for the disparities experienced by the minority populations during the two pandemics. Ultimately, it was established that the causes of the disparities noted was found to be differences in social determinants of health experienced by minority populations including poverty, education, occupation, and housing location. Differences in each of these social determinants of health then led to disparities in exposure, susceptibility, and treatment. All of these disparities combined together caused disproportionate affliction and mortality for minority populations during both pandemics. Organizing disparities in terms of social determinants of health and identifying possible explanations for disparities is important for future pandemic planning, and the model of Blumenshine et al. (2008) is a structured way to hypothesize certain causes of disparities during a pandemic based on social determinants of health. Emphasis needs to be placed on developing a pandemic vulnerability index based on the measures hypothesized so that future pandemic planning can direct resources to those most vulnerable.

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Chapter One: Introduction

Disparities in affliction and mortality during pandemics continue to be a public health crisis. Researchers have noted how racial and socioeconomic disparities in pandemics affect affliction and mortality in the United States (Holtgrave et al. 2020). Among the most recent pandemics is the Swine Flu pandemic of 2009, during which Blacks, Hispanics, and Native American populations suffered disproportionately high mortality rates when compared to their White counterparts (Centers for Disease Control and Prevention, 2009; Soyemi, et al. 2014). Currently, the United States is in the midst of another pandemic, COVID-19, which has claimed over half a million lives in the United States and over a million globally. In the winter of 2020, the United States had the highest mortality rate of any country, and the number of people both contracting and dying from COVID-19 were on an upward trajectory. Research demonstrates a wide disparity in mortality rates across racial lines (Strickland et al. 2020). In a study on the disparities of COVID-19, researchers reported counties with predominantly Black residents possessing a mortality rate six times higher than counties with predominantly White residents (Yancy, 2020). This thesis will analyze the manifestation of disparities in the Swine Flu and COVID-19 pandemics. These disparities will then be assessed to understand underlying causes in terms of social determinants of health.

History and Timeline of Swine Flu and COVID-19

Swine Flu Pandemic

The Swine Flu pandemic emerged in early April 2009 causing one of the first global pandemics in decades. Its origin as indicated by phylogenetic analysis nestles it within swine

influenza viruses and hence its name Swine Flu (Jon & Scott, 2014). The 2009 strain that caused the pandemic is known as H1N1. The H and N followed by numbers indicate the type of antigenic site displayed on the virus. H stands for hemagglutinin and N stands for neuraminidase both of which are common antigenic sites identified by host immune systems (CDC, 2019). The first reported case of Swine Flu in the United States occurred in the State of California. In response, the Centers for Disease Control and Prevention (CDC) immediately began to notify the World Health Organization (WHO) and activated its emergency operations center, however; subsequent infections ensued and the Swine Flu became a nationwide crisis. The CDC continued its investigation into these viral outbreaks and by April 25th 2009 the WHO declared an international public health emergency, consequently; the CDC began to prepare for a greater surge in cases and mortality. They began to release antiviral drugs from the federal stockpile and issued guidelines for operation of educational institutions. Although these measures were taken, the Swine flu infection rate peaked in the United States between May and June of 2009. However, even amidst this tense time researchers continued to develop a vaccine and began clinical trials in July of 2009. By September of 2009, the Food and Drug Administration (FDA) approved four Swine Flu vaccines. By December of 2009, vaccination became available and accessible in the United States (Centers for Disease Control and Prevention, 2019).

Although the Swine Flu pandemic eventually ceased, the mortality rates reveal underlying disparities. For example, the CDC noted that in the United States there were a total of 274,304 hospitalizations, 12,469 deaths, and 60.8 million cases (Centers for Disease Control and Prevention, 2019). These statistics included a large number of minority populations that were disproportionately affected across the country. Research published by the CDC's Morbidity and

Mortality Weekly Report (MMWR) found that Native Americans had a mortality rate higher than all other racial groups combined (Centers for Disease Control and Prevention, 2009).

Furthermore, such disparities were also present in hospitalization due to Swine Flu. Soyemi et al. (2014) indicated that hospitalization for Blacks was two to three times higher when compared to their White counterparts. Even though this pandemic subsided, minority populations continue to be disproportionately affected in pandemics, and this is now starting to be displayed during the current COVID-19 pandemic.

COVID-19 Pandemic

COVID-19 manifested in late 2019 as a novel Coronavirus. Coronaviruses are a group of viruses that infect respiratory epithelial cells and symptoms include: fever, muscle aches, and in extreme cases shortness of breath and difficulty breathing. Coronaviruses are named after their antigen proteins representing a crown like structure called *corona* (Johns Hopkins, 2021).

COVID-19 first emerged in Wuhan China December 2019. The Wuhan Municipal Health Commission began to report these cases to the WHO and the WHO began to monitor the outbreak. The WHO continued to keep close contact with Wuhan health authorities and started to inform the international community. However, COVID-19 continued to spread in Wuhan, and eventually, the first case outside of China was reported in Thailand. The WHO continued to supply international support, but COVID-19 spread rapidly. By April 4th, 2020 the WHO reported over a million confirmed cases worldwide (World Health Organization, 2020). In response, the WHO and CDC began to issue guidelines regarding mitigation of the spread of COVID-19. These guidelines included social distancing protocols and face mask use when in public settings. Even with these guidelines COVID-19 continued to spread and the international

community began working together on developing a vaccine. As of March 2021, there are three vaccines approved for use within the United States. These include the Pfizer-BioNtech, Moderna, and Johnson & Johnson vaccines (CDC, 2021). Although vaccines are now being disseminated within the United States, the infection and mortality rates continue to increase and reveal significant Racial/SES disparities similar to those during the Swine Flu.

As of March 2021, the United States had one of the largest infection and mortality rates when compared globally (Johns Hopkins University & Medicine , 2021). With the death toll climbing above two hundred thousand, this pandemic is more severe than the Swine Flu in terms of fatality rates and affliction outcomes. This concerning high mortality rate has also disproportionately affected minority communities, as did the Swine Flu, for example; as indicated by research Blacks are dying at a rate of two times that of White individuals (Yancy, 2020). Also, as of November 2020 minority groups such as Hispanics and American Indians had some of the highest mortality rates (The Atlantic, 2020)¹. As of March 2021, the world is still amid COVID-19, and questions relating to the causes of pandemic disparities need to be addressed.

Disparities in Pandemics and Social Determinants of Health

Disparities in pandemic affliction and mortality continue to be ubiquitous. The CDC indicates that health disparities result from mostly economic and environmental factors. Examples include poverty, educational inequalities, and inadequate access to healthcare (CDC, 2020). A classic example of the impact of such factors is the 1848 typhus pandemic in Silesia.

¹ The COVID-19 racial data tracker is a project in collaboration with Boston University center for antiracist research and the Atlantic's "The COVID Tracking Project."

The famous German physician, Rudolf Virchow, cited poverty, lack of education, and hunger to be causes for the infection outbreak (Ponnambalam et al. 2011). Virchow's findings exemplify why many researchers study social determinants of health when analyzing healthcare disparities. The WHO defines social determinants of health as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life” (World Health Organization,2021) . These social determinants of health can influence outcomes in pandemics, for example, social determinants of health are just as important as understanding how one's genetics affect health outcomes. Researchers have noted that a person's zip code is just as important as an individual's genetic makeup when predicting their health risks (Strickland et al. 2020). There are several social determinants of health but the ones that will be mentioned in this thesis are education, occupation, and income. These three influence where one will live and the type of interactions one will have in society. Each of these major social determinants of health is discussed below to give a general understanding.

Education

Education is a critical social determinant of health in influencing the location of residence and future employment of an individual. Not only does education impact future career and income, but it also contributes to decisions regarding lifestyle choices that impact health outcomes such as cigarette usage (Garett et al. 2019). Research indicates that education is associated with life expectancy, lowers mortality risk, and lowers the possibility for negative health outcomes (Shanker et al. 2013; The Lancet, 2020) . Individuals who are educated have lower rates of chronic illnesses such as diabetes, circulatory disorders, and liver disease (Hahn & Truman, 2015). Furthermore, education also gives one greater personal control, the feeling of

having control over outcomes in ones life which has been linked to better health related behavior (Shanker et al. 2013). Education may lead people to make more informed decisions about their health and this in turn could lead to optimal health outcomes during a pandemic.

Occupation

One's occupation is an important social determinant of health that could affect disparities during a pandemic. Strickland et al. (2020) indicated that where a person works often dictates the type of exposures they have; for example, exposures such as “noxious and dangerous chemicals” or other agents that can affect ones health, and this statement holds true when the other agents that affect ones health are pathogenic microbes causing a pandemic. Researchers have concluded that COVID-19 disparities can stem from disparities in exposure (CDC, 2020). This evidence supports the fact that minority populations who work in essential industries such as food processing, public transportaion, and retail are increasing their possibility of exposure to COVID-19 (CDC, 2020). Furthermore, many of these occupations that minority populations such as Blacks and Hispanics occupy prevent them from working at home (Rubin, 2020). As a result, these outcomes of practicing a particular occupation make it an essential social determinant of health possibly influencing ones experience in a pandemic.

Income

Income is arguably the most important social determinant of health as it affects the type of healthcare one can afford, the quality of schooling one can attain, and the types of food one can consume (Strickland et al. 2020). This acquisition of basic food items becomes threatened in low income populations during a pandemic. While the more affluent can have grocery items

delivered, lower income populations have to resort to decreasing grocery shopping. Sharma et al. (2020) found that during the COVID-19 pandemic lower income households decreased grocery shopping and fruit/vegetable consumption. Furthermore, almost 95% of participants in the study reported being food insecure. Food insecurity and a decrease in fruit/vegetable consumption can contribute to negative health outcomes during a pandemic. The CDC notes that fruit/vegetable consumption can decrease ones risk for heart disease, stroke, and some cancers (CDC, 2021). Having food insecurity prevents one from acquiring basic food items and protecting oneself from these diseases; as a result, this can increase ones risk of severe COVID-19 infection. Income is also associated with the prevalence of chronic illness; for example, Ogden et al. (2017) confirmed that individuals with lower income had higher rates of obesity. Obesity has a serious effect on one's health as it is noted that obesity can lead to other chronic illnesses such as diabetes, hypertension, and cardiovascular disorders (CDC, 2020). Furthermore, individuals who are obese have a greater mortality risk when it comes to COVID-19 infection (CDC, 2020). This research indicates how pertinent income is to one's health outcomes.

Model of Blumenshine et al. (2008)

Blumenshine et al. (2008) developed and adapted an existing model explaining the causes of pandemic disparities and pointed to the fact that social determinants of health are at the root cause of disparities in pandemics. The aggregation of the effects of numerous social determinants of health such as income, education, and occupation lead to the experience of disparities on three different levels. These levels are²: 1) disparities in exposure to the pathogen, 2) disparities in

² The author uses the term “pathogen” when describing this model as it will be used to explain causes behind the COVID-19 and Swine Flu pandemic disparities. Blumenshine et al. (2008) uses the term “influenza disease” as this model was developed on the basis of pandemic Influenza planning.

susceptibility to contracting the pathogen once exposed, and 3) disparities in treatment once the disease begins to develop. The experience of disparities on these three levels add together and cause the disproportionate infection, hospitalization, and mortality that has seized minority populations during these two pandemics.

The first level includes disparities in exposure to the pathogen which can occur in many settings and is amplified as a result of certain locational and occupational circumstances. For example, minority populations, Asians and Hispanics, are known to live in crowded conditions, and living in crowded conditions is a risk factor for exposure to a pathogen and is associated with poverty (Blumenshine et al. 2008). Poverty, a social determinant of health, can therefore dictate where one will live and the intensity of exposure one has.

The second level includes disparities in susceptibility to contracting the pathogen once exposed. Underlying risk factors such as medical conditions, vaccine schedule, and other health related statuses can influence one's susceptibility (Blumenshine et al. 2008). Those with chronic illnesses such as cardiovascular disease, obesity, and hypertension are at greater risk when it comes to susceptibility of contracting and developing severe infection, and prevalence of these chronic illnesses is known to exist among minority populations disproportionately (Davis et al. 2017). The disproportionate affliction with chronic illnesses is due to several social determinants of health that include access to healthcare, education about preventative measures, and community conditions all of which influence minority populations risk factors for acquiring chronic illnesses (CDC, 2020).

The last level is disparities in treatment once disease has developed. Timeliness in accessing adequate medical care is important to prevent severe infection from ensuing, and

minority populations are known to have difficulty in accessing healthcare. Blacks and Hispanics are significantly less likely than Whites to report having a usual primary care physician (Blumenshine et al. 2008). Furthermore, individuals with low income are two times as likely to lack a routine source of healthcare (Blumenshine et al. 2008).

The additive effects of multiple disparities on these three levels leads to unequal experience of infection and mortality. For example, an individual who lives in a crowded space, has COPD, and does not receive regular care from a provider is experiencing disparities on all three levels mentioned. If this individual then lives in a society experiencing a pandemic he will be at risk for severe infection and mortality. This is currently the situation for several minority populations within the United States. Therefore, applying this model to Swine Flu and COVID-19 to understand the social determinants of health causing disparities on the three levels mentioned is important. After which, a solution needs to be formulated to target how to improve the lives of those experiencing disparities.

Chapter Two: Purpose

It is critical to understand the manifestation of disparities in affliction and mortality during the COVID-19 and Swine Flu pandemics as they are the most recent to affect the United States. With COVID-19 cases in the United States increasing, conducting a detailed study to evaluate disparities is needed. With the Swine Flu preceding COVID-19 by a decade, the two pandemics can be compared to identify themes in affliction and mortality. The objective of this thesis is to identify the various types of disparities, such as race and socioeconomic status, that affect the rate of affliction and mortality. These themes will be used to clarify the underlying causes behind these disparities in light of social determinants of health. The model of Blumenshine et al. (2008) will be used to structure and guide this analysis.

Significance of This Study

The findings of this study will contribute to the benefit of public health by clarifying themes in disparities and underlying causes behind those themes. Consequently, public health officials can use those themes and causes to understand disparities in future pandemics. Although an understanding of these causes is a good start, structural change is needed to reduce disparities in future pandemics. Policy makers must use this evidence to direct change in the United States healthcare system. This can be accomplished by implementing novel programs and theories that use these findings to command change. Lastly, there is also a need to synthesize the current literature on the COVID-19 pandemic. To the knowledge of the author, a literature review applying the Blumenshine et al. (2008) model to both Swine Flu and COVID-19 has yet to be completed. This review will contribute to the myriad of studies conducted on these two pandemics by synthesizing the causes of disparities and hypothesizing several measures that may

have led to these disparities. It will also propose several solutions that can be implemented by policy makers for future pandemic planning.

Chapter Three: Methods and Procedure

Search strategy

The search strategy used to conduct this review was a search through scholarly peer-reviewed journal articles. A refined search using *EBSCO Host* through the University of Central Florida's database was accessed, and filters were placed to focus on articles categorized under the field of health and medicine. The databases accessed were *Medline/PubMed*, *CINAHL Plus*, and *Science citation index*. Papers published in the English language from January 2009 to October 2020 were considered.

Inclusion Criteria

Studies included were those conducted in the United States alone due to the outsized impact of COVID-19 in the United States. The United States, for several months, was leading in cases and mortality and the focus is on observing its disparities. The study designs included are mixed methods, case-control, and quantitative studies. Studies included are those that focus on racial/socioeconomic disparities in affliction and mortality concerning COVID-19 and Swine Flu of 2009. This search hosted several terms to search for articles within the two databases. The terms used to search for articles on disparities in mortality and affliction with regards to Swine Flu are outlined in Table 1. The inclusion and exclusion criteria used for this search is organized in Table 2, and the terms that were used to search for articles relating to COVID-19 disparities have been outlined in Table 3.

After gathering the articles for this review a summary is provided in the "findings from the literature" section. This section summarizes the studies and their findings categorized based on a theme. In the results/analysis section, a comparison is given between the two pandemics and

their disparities. Furthermore, that section includes an analysis identifying the causes behind the noted disparities with the model of Blumenshine et al. (2008) used to organize the social determinants of health and their impact on the three levels mentioned.

Search terms used in Ebsco Host for articles related to Swine Flu
H1N1 pandemic 2009 OR H1N1 OR Swine Flu OR Swine Flu Pandemic AND
Disparities OR inequality OR Unfair OR Disproportionate OR Difference OR Discrepancy OR Variation OR Polarity OR Dissimilarity OR Imbalance OR Incongruity OR Unevenness OR Gap OR Contrast OR Disparity OR Susceptibility OR Health AND
Racial OR African Americans OR Latino OR Ethnic OR Minority OR Socioeconomic OR Race OR Ethnicity AND
Prevalence OR Incidence OR Mortality OR affliction OR Pervasiveness OR Frequency OR Occurrence OR Exposure OR Outcome

Table 1: Search Terms Entered into EBSCO for Swine Flu Articles

Inclusion Criteria	Exclusion criteria
Topic: Papers evaluating socioeconomic/racial disparities in <i>affliction</i> and <i>mortality</i> concerning the COVID-19 pandemic and the Swine Flu Pandemic.	Papers evaluating disparities in other areas such as vaccination, testing, or usage of treatment
Location: Studies conducted in the United States	Studies conducted in other parts of the world
Language: English	Other languages besides English
Publication dates: January 2009-October 2020	Dates before January 2009 or after October 2020
Study Designs: Mixed methods, case-control and those quantitative in nature	Studies that do not fall under quantitative, mixed methods, or case-control study designs
Sources used: Papers published in peer-reviewed journal articles or reports from the CDC and WHO	Papers not published in peer-reviewed journal articles or not coming from the CDC or WHO

Table 2: Research Inclusion and Exclusion Criteria

Search Terms used in Ebsco Host for Articles Related to COVID-19
COVID-19 OR Coronavirus OR Sars-Cov-2 OR Coronavirus pandemic AND
Disparities OR inequality OR Unfair OR Disproportionate OR Difference OR Discrepancy OR Variation OR Polarity OR Dissimilarity OR Imbalance OR Incongruity OR Unevenness OR Gap OR Contrast OR Disparity OR Susceptibility OR Health AND
Racial OR African American OR Color OR Ethnic OR Minority OR Socioeconomic OR Latino OR Race OR Ethnicity AND

Prevalence OR Affliction OR Mortality OR Incidence OR Pervasiveness OR Frequency OR Occurrence OR Exposure OR Outcome

Table 3: Search Terms Entered into EBSCO for COVID-19 Articles

Articles related to the Swine Flu Pandemic

After entering the search terms into EBSCO a total of 267 articles were found. After adjusting for studies conducted in the United States and the specific databases were chosen, EBSCO gave 41 articles and removed 226. From those 41 articles, 13 were selected for further analysis. There were 28 articles excluded from this analysis because they discussed disparities other than affliction and mortality. From the 13 articles selected only 8 were chosen to be included in this thesis. Of the four articles excluded one was looking at the pandemic of 1918, the second was studying vaccine uptake, and the third study was conducted in Canada and this review will only look at studies conducted in the United States. Last, the fourth study was conducting a comparison between two other influenza pandemics, and the fifth study was analyzing whether AI/AN racial status was an independent risk factor for contraction of Swine Flu.

Articles related to the COVID-19 Pandemic

Once the search terms were entered into EBSCO a total of 1,655 articles were found. Of those 1,655 articles 657 articles were excluded because they were not from the three specific databases used for this thesis. After adjusting for research only conducted in the United States, a total of 217 articles were left. EBSCO then removed the duplications leaving a total of 193 articles. A title search was then conducted and 67 articles were selected for further analysis. 126

articles were excluded because disparities other than affliction and mortality were being studied. Furthermore, some of those 126 were not studying disparities but were studying other aspects of the pandemic. After a thorough analysis of the methods and abstracts of the 67 articles, 33 articles were chosen for a full read and a detailed study. The 34 articles that were excluded were done so because of methods and procedures not analyzed by this review, such as literature reviews and qualitative research. From the 33 articles reviewed, 29 were determined to be included in this thesis. Four were excluded because they analyzed the causes of disparities and/or were conveying descriptive statistics of affliction and mortality.

Institutional Review Board

This thesis will not require approval from the Institutional Review Board as it utilizes publicly accessible information. No human or animal subjects will be used to research this thesis. All information included within this thesis is taken from public databases.

Chapter Four: Findings from The Literature

This section identifies disparities that were indicated by the articles analyzed. The disparities are categorized based on theme according to the respective pandemic. The two themes identified in the literature are 1) racial/ethnic disparities and 2) socioeconomic disparities. Clarified under each theme are the disparities related to affliction and mortality. Included in this section is a summary of the findings used for further analysis in the results/analysis section. This summary is completed for both pandemics starting with Swine Flu and then proceeding with COVID-19. Each section on racial/ethnic disparities includes a summary of the findings for every racial group that experienced disparities. In the socioeconomic-disparities sections, a discussion related to disparities in each socioeconomic indicator, education level, and neighborhood poverty is provided. Appendix A tabulates all of the articles obtained from this literature search.

Swine Flu Pandemic Racial/Ethnic Disparities

After analyzing the literature, three racial/ethnic minority groups were identified as having disproportionate affliction and mortality. The racial/ethnic groups severely affected were the American Indian/Alaskan Native (AI/AN), Black, and Hispanic communities. The studies that were conducted analyzed sample populations from across the United States, and the researchers from the majority of the studies were analyzing disparities in reported influenza-like illness, mortality, and hospitalization. The outcome of studying these measures inform one of the impact Swine Flu had on each racial group as these measures cover a wide range of where disparities could occur. Depending on the methods of each study different databases were used and accessed to acquire knowledge of hospitalization, mortality, and reported influenza-like

illness. Furthermore, researchers defined influenza-like illness differently. For example, Dee et al. (2011) defined it as "fever accompanied by either cough or sore throat" while Placzek and Madoff (2014) used several ICD-9 codes to identify an influenza-like illness. All of the articles included in this thesis conducted their research on populations that were infected between April 2009 to December 2009.

American Indian and Alaskan Natives (AI/AN)

The AI/AN populations were one of the most impacted racial groups during the Swine Flu pandemic. Several researchers noted mortality rates, hospitalization, and reported influenza-like illness (ILI) disproportionately for this group. Finally, it was also noted that AI/AN populations had increased prevalence of chronic illnesses and were twice as likely to have unmet medical needs (Centers for Disease Control and Prevention, 2009). As I demonstrated in the results/analysis sections these SDH's may have contributed to their experience of disparities.

Hospitalization. In a study conducted by Dee et al. (2011), they found hospitalization rates for AI/AN population to be 32.7/100,000 during the fall/winter influenza season. This hospitalization rate was the highest amongst all racial groups studied during that period.

Mortality. Mortality rates for this racial group were also disproportionate; for example, in the famous study conducted by the CDCs' MMWR, it was discovered that AI/AN individuals had a mortality rate four times higher when compared to all other racial groups combined (Centers for Disease Control and Prevention, 2009).

Reported ILI. Reported ILI was also high among this population. Dee et al. (2011) noted that among this population self-reported ILI was higher when compared to all other racial groups.

Blacks

Black communities experienced disproportionate affliction and mortality similar to that of AI/AN including disparities in hospitalization, mortality, and influenza-like illness.

Hospitalization. One study conducted by Soyemi et al. (2014) indicated that hospitalization rates for Blacks were two times higher when compared to their White counterparts and this study was not the only one that confirmed this. Several other researchers concluded this finding including Dee et al. (2011) and Placzek & Madoff (2014) reporting hospitalization rates of 10.9/100,000 and 15/10,000 respectively.

Mortality. Mortality was also disproportionate amongst the Black population. The same researchers that noted disparities in hospitalization also noted disparities in mortality (Soyemi et al. 2014) reporting mortality rates of 1/100,000.

Reported ILI. With regards to influenza-like illness, Placzek & Madoff (2014) identified that blacks had the highest rate of influenza like illness, and they reported this to be 15 cases per 10,000 respectively.

Hispanics

Hispanic communities experienced similar disparities in hospitalization, influenza-like illness, and mortality.

Hospitalization. Soyemi et al. (2014) found similar hospitalization rates as Blacks when studying the Hispanic population finding that Hispanics had a hospitalization rate of 2-3 times that of Whites. Numerically this rate was 35/100,000 for Hispanics compared to 13/100,000 for Whites. This higher hospitalization rate for Hispanics was noted by Dee et al. (2011) and Truelove et al. (2011). For example, Truelove et al. (2011) found that Hispanics had some of the

highest hospitalization rates during wave one, 15 April-August 2009, when compared to their white counterparts. This greater hospitalization rate for Hispanics was confirmed by Dee et al. (2011) conveying a hospitalization rate of 8.2/100,000, this being compared to the hospitalization rate of Whites, 3.0/100,000, is almost three times higher. The findings of these studies indicate collectively that Hispanics had disproportionate hospitalization.

Reported ILI. Influenza-like illness was also reported disproportionately for Hispanics. Placzek & Madoff (2014) reported that Hispanics had influenza-like illness rates almost twice that of their White counterparts. These results contradict what Dee et al. (2011) found in their study which reported that the prevalence of reported influenza-like illness was lower among Hispanics when compared to Whites. These discrepancies could be a result of the differences in how both researchers defined Influenza-like illness. Furthermore, another reason for these differences could be a result of the population sample being different. Placzek & Madoff (2014) studied populations within Massachusetts while Dee et al. (2011) sampled their population from the Behavioral Risk Factor Surveillance System: an ongoing data collection program monitored and operated by the CDC. Even though these differences exist, given that Hispanics experienced disparities in Hospitalization and Mortality is enough to conclude that they experienced disparities in reported ILI.

Mortality. With regards to mortality rates, Hispanics had some of the highest among other racial groups. Soyemi et al. (2014) noted that in their analysis of hospital systems in Illinois Hispanics had the largest mortality rate. This was at 1/100,000 which was almost twice that of Whites. Another study confirmed the high Hispanic mortality rate; however, this was conducted

with pediatric patients. Dee et al. (2011) found that pediatric deaths due to Swine Flu was higher than expected among Hispanic patients.

Swine Flu Pandemic Socioeconomic Disparities

Analyzing the literature led to the discovery of several socioeconomic disparities in Swine Flu affliction and mortality. There are many ways in which researchers measure these socioeconomic disparities, for example, Levy et al. (2013) used education level and neighborhood poverty to measure and define socioeconomic status while Placzek & Madoff (2014) used the American Community Survey database to gather information on socioeconomic status. From this government database, they used zip code and income to define socioeconomic status. Therefore, this thesis categorizes socioeconomic disparities under education level and neighborhood poverty.

Education level

Education level was found to significantly affect disparities in hospitalization and mortality. Levy et al. (2013) found that adults without a high school education were 32 times more likely to be hospitalized when compared to college graduates. Furthermore, they found that adults with a high school education were 4.5 times more likely to be hospitalized than individuals with some college education. Ponnambalam et al. (2011) further studied the relationship between education and mortality. They found that U.S. counties with lower educational attainment reported greater mortality. Although these were the only two studies looking at education level and disparities, they indicate significant relationships between educational level and outcomes during a pandemic. Education is a social determinant of health, and these two studies confirm its importance in deciding health outcomes.

Neighborhood poverty

Neighborhood poverty was associated with an increased risk of hospitalization. Levy et al. (2013) found that for both adults and children neighborhood poverty was a big factor in the odds of hospitalization. These results were also confirmed by Placzek & Madoff (2014) who found that among those admitted to the ICU they represented the lowest socioeconomic status. Placzek & Madoff (2014) specifically analyzed neighborhood poverty as it relates to racial groups. Among Hispanics and Blacks admitted to the ICU they found them to be in the lowest socioeconomic group. This study illustrates the relationship between race, socioeconomic status, and disparities; this relationship is discussed in greater depth in the results/analysis section. Although these were the only two studies that analyzed disparities and neighborhood poverty, they confirm each other's results. Levy et al. (2013) conducted their study in a New York City hospital system while Placzek & Madoff (2014) conducted their study in Massachusetts. The similarity in their findings indicates that poverty influences disparities.

COVID-19 Pandemic Racial and Ethnic Disparities

The literature suggests four Racial/Ethnic groups disproportionately affected by COVID-19: Blacks, Hispanics, Asians, and AI/AN populations. The themes in disparities affecting these groups included infection, hospitalization, and mortality. The studies used data from across the United States representing numerous cities and diverse healthcare systems and studies were conducted between January 2020 to October 2020. The congruency of their findings support the argument that these four racial groups experienced the highest level of disparities.

Blacks

Blacks are currently the most affected minority group during the COVID-19 pandemic. Out of the 29 articles used in this review of the literature on COVID-19, 22 noted significant disparities for the Black population in infection, hospitalization, and mortality.

Infection. Millett et al. (2020) assessed differential impacts of COVID-19 on Black communities and found that counties with a higher proportion of Black individuals had higher COVID-19 diagnoses. These results were confirmed by Mahajan & Larkins-Pettigrew (2020), Kim & Bostwick (2020), Cheng et al. (2020), and Scannell et al. (2020), who found a positive correlation between the percentage of Blacks living in a county and the percentage of COVID-19 cases. These studies were conducted across numerous states within the U.S. supporting the conclusion that Blacks are experiencing disproportionate infection rate. In models not observing relationships between county demographic and COVID-19 infection, similar disparities were also noted. For example, Rozenfeld et al. (2020) determined from data supplied by the Providence Health care system that Blacks had a higher risk for infection. Other studies found that Blacks had some of the highest infection rates when compared to other racial groups and this was noted by Haywood et al. (2020), Rosenberg et al. (2020), and Rentsch et al. (2020) who all concluded disproportionate infection rates for Blacks. Furthermore, Goyal et al. (2020) looked at infection disparities in children and found that Black children had higher rates of infection when compared to other racial groups.

Hospitalization. Several researchers found disproportionately higher hospitalization rates for Blacks. Haywood et al. (2020) found that, in a large cohort in Louisiana, 76.9% of the patients hospitalized were Black. Similarly, Holtgrave et al. (2020) found that hospitalization

rates for Blacks in the state of New York were two times higher when compared to their White counterparts. Furthermore, Azar et al. (2020) found that Black patients were 2.7 times likely to be hospitalized compared to other racial groups of similar age and comorbidities, and Blacks were also more likely than Whites to be admitted into the ICU showing signs of greater severity in illness. Collectively these studies demonstrate that Blacks were experiencing disproportionate hospitalization.

Mortality. Mortality rates were of the most studied epidemiological indicators with respect to the Black population. Of the respective articles, 12 articles analyzed disparities in mortality rates and all of them identified an underlying theme: that Blacks had disproportionate mortality rates when compared to other racial groups. Scannell et al. (2020) found that counties with a higher number of Black individuals had an increasing number of COVID-19 deaths; also, Kim & Bostwick (2020) found that in several Chicago community areas that Blacks accounted for 62.8% of COVID-19 deaths. Cheng et al. (2020) further concluded that counties with higher percent Black populations had an increase in COVID-19 mortality rates with some of these being as high as 39.3 per 100,000. Associations between percent Blacks living in a county and mortality rates were also discovered by Mahajan & Larkins-Pettigrew (2020) and Millett et al. (2020), both of which found disproportionately higher Black counties having larger mortality rates. Analysis of mortality rates in hospital systems also revealed underlying disparities. Haywood et al. (2020) found that among the 326 patients who died from COVID-19, 70.6% were Black. All of these studies collectively indicate that Blacks were experiencing disproportionate mortality rates. Even though the overwhelming majority of the studies indicated similar findings, there existed two studies that were inconsistent with the rest of the articles. The

first of these two studies were conducted by Rentsch et al. (2020) who found that among those tested positive for COVID-19 there was no difference in 30-day mortality by race or ethnicity, however; this conflicting evidence could be the consequence of the sample population used in the study. Rentsch et al. (2020) gathered data from the VA healthcare system, and these results could be from the nature of the VA healthcare system serving a specific population of veterans; therefore, these results may be representative of the veteran population and not the United States as a whole. The second study conducted by Yehia et al. (2020) found that mortality did not differ between Black and White patients in those able to access hospital care. This study was specifically analyzing mortality in populations able to access hospital care and, therefore, is not representative of other populations that were examined by the remainder of the studies.

Hispanics

Hispanic individuals experienced similar disparities during COVID-19 with 13 of the 29 articles reporting disparities in infection, hospitalization, and mortality.

Infection. Holtgrave et al. (2020) found increased likelihood of COVID-19 infection amongst Hispanic individuals with a per population likelihood of COVID-19 diagnosis of 1.85% compared to 0.93% for Whites. Rosenberg et al. (2020) further determined increased incidence of COVID-19 amongst Hispanics. They analyzed a sample size from New York city and found that Hispanics had an incidence rate of 29.2%, and this being the highest amongst any other racial group they studied. In studies analyzing COVID-19 hotspots by county, Moore et al. (2020) found Hispanics were the largest racial group living in counties identified as COVID-19 hotspots. Finally, when looking at disparities in children, Goyal et al. (2020) found that of those pediatric patients that tested positive for COVID-19, 46.4% were Hispanic. These studies

collectively exemplify the burden that the Hispanic population is facing due to COVID-19 infection.

Hospitalization. The Hispanic population, as indicated by the results of the studies, experienced underlying disparities in hospitalization. Tenforde et al. (2020) ascertained that the majority of those hospitalized among the patient cohort sample were Hispanics; this study was conducted across nine states representing 11 academic medical centers. Holtgrave et al. (2020) also confirmed disproportionate hospitalization rates experienced by Hispanics with 26.2% of those diagnosed hospitalized; in other words, this equates to 13,241 Hispanics Hospitalized while only 9,884 Whites were hospitalized.

Mortality. Mortality rate was also experienced disproportionately by the Hispanics. Rossen et al. (2020)³ found that Hispanics had some of the largest percent increase in excess deaths; this analysis of excess deaths provides researchers with an account of mortality related to COVID-19 allowing them to compare trends in mortality rates with historical norms. In another study Holtgrave et al. (2020) determined that Hispanic populations were 3.48 times more likely to die from COVID-19 when compared to other racial groups. Cheng et al. (2020) found that of the 20 rural counties studied with the highest COVID-19 mortality rates many of them were in the top quartile of percent Hispanic. Furthermore, they found that counties with the highest percent Hispanic populations had higher average daily increases in COVID-19 deaths. Gold et al. (2020) found that during May to August all racial groups decreased in percentage of deaths except Hispanics. Their percentage of deaths increased from 16.3% to 26.4%.

³ “Excess deaths are defined as the number of persons who have died from all causes, in excess of the expected number of deaths for a given place and time” Rossen et al. (2020).

Asians

Of the total, four articles mentioned disparities experienced by the Asian community possibly indicating that Asians experienced disparities less severe than that of Blacks and Hispanics. For example, Rosenberg et al. (2020) found that incidence of COVID-19 was 12.4% for Asians almost half that of Hispanics and Blacks. Even though their experience was less than that of Blacks and Hispanics it was still twice that of White individuals. Also, disparities still existed within the Asian community, for example, Mahajan & Larkins-Pettigrew (2020) found a positive correlation between percentage of Asians living in a county and infection and death from COVID-19. Lastly, Rozenfeld et al. (2020) found that Asian race was associated with higher risk of COVID-19 infection.

American Indian and Alaskan Natives (AI/AN)

The AI/AN population is experiencing disproportionate COVID-19 disparities similar to those during Swine Flu. In a study conducted by Hatcher et al. (2020) they found that incidence for AI/AN population was 594/100,000. This study was conducted across 23 states and was almost four times higher than the incidence rate for whites. This nationwide study indicates that this racial group is experiencing disparities in COVID-19 affliction similar to other racial minorities.

COVID-19 Pandemic Socioeconomic Disparities

Several studies noted socioeconomic disparities in COVID-19 affliction and mortality. The majority of these studies were using neighborhood poverty as a measure of socioeconomic status; for example, Fielding-Miller et al. (2020) found that percentage of residents living at or below the federal poverty line was associated with greater COVID-19 mortality. Furthermore,

they also indicated that in rural counties each percentage point of individuals living in poverty was associated with 4.41 additional deaths. Such mortality rates experienced by impoverished counties was also noted by other researchers. Adhikari et al. (2020) found that there existed substantially greater infection and mortality due to COVID-19 in counties that were impoverished. This was also confirmed by Goyal et al. (2020) who found that socioeconomically disadvantaged children were more likely to contract COVID-19.

Chapter Five: Results and Analysis

Causes of Disparities in Swine Flu and COVID-19

In this section the model of Blumenshine et al. (2008) is applied to the Swine Flu and COVID-19 pandemics. Using the social determinants of health observed throughout the studies an explanation for disparities on the three previously mentioned levels is provided within each section. The last section provides a brief summary of how disparities experienced on all three levels is contributing to the previously mentioned Racial/SES disparities. Applying this model to these two pandemics may help policy makers identify possible causes of disparities and will also organize the findings of the respected researchers in terms of social determinants of health and the levels outlined in the model. Even though this model may not establish direct causality, the objective is to improve future pandemic planning by targeting possible issues that could lead to disparities.

Differences in Social Determinants of Health

Examples of social determinants of health noted in individuals during the Swine Flu and COVID-19 pandemics are education, housing location, poverty, and occupation; these social determinants of health were observed by a number of articles included in the literature review. A short explanation about each social determinant of health and how it was observed during Swine Flu and COVID-19 is described in each section below.

Education. Education level, as previously noted, was associated with the odds of hospitalization and mortality during Swine Flu (Levy et al. 2020; Ponnambalm et al. 2011); furthermore, minority populations, Blacks and Hispanics, are known to possess lower levels of

education (National Center For Educational Statistics , 2019). This social determinant of health may have contributed to the disproportionate experience of these populations during both pandemics; for example, Individuals who have less education may have been unaware of the risks associated with infection or certain underlying conditions (Levy et al. 2020).

Housing location. The second social determinant of health, housing location, was also noted amongst minority populations. Researchers found that Blacks and Hispanics were more likely to live in crowded conditions during the Swine Flu pandemic (Quin et al. 2011). Furthermore, during the COVID-19 pandemic large- crowded cities were known to be epicenters housing greater infection (Zhang & Schwartz, 2020). This is also an example of a social determinant of health that was experienced differently by minority populations.

Poverty. Another social determinant of health that impacted minority populations is poverty. Researchers found that during COVID-19 those residing in low-income zip codes were more likely to be hospitalized when compared to those residing in wealthier zip codes. It was also noted that Blacks who were hospitalized lived in zip codes with the lowest income when compared to other racial groups (Azar et al. 2020).

Occupation. The last social determinant of health mentioned is occupation. Blacks and Asians were found to be employed in occupations that were considered to confer greater risk for infection. Hispanics and Blacks were also more likely to be employed in slaughterhouses where known outbreaks have occurred (Hawkins, 2020).

The listed social determinants of health are examples of possible causes of disproportionate affliction and mortality during Swine Flu and COVID-19. These four are not meant to be an exhaustive list, but to serve as examples of trends in social determinants of health

observed in the literature. Now the author explains how the previously mentioned social determinants of health experienced by minority populations during these two pandemics could lead to disparities in exposure.

Disparities in Exposure to Swine Flu and COVID-19

The author hypothesizes several measures of exposure that determine increased risk of exposure to COVID-19 and Swine Flu; these include living in a metro/crowded area, inability to work from home/working in essential industries, living in an area with greater social vulnerability, and living in impoverished communities. Individuals who experience these measures of exposure are likely to experience disparities in exposure to Swine Flu and COVID-19. It is not surprising that minority populations possess these measures of exposure and are therefore experiencing disproportionate affliction and mortality during Swine Flu and COVID-19. All of these measures of exposure are the result of the previously mentioned four social determinants of health. The author explains each measure in detail in the sections below.

Living in a metro/crowded area. Living in a metro area is an excellent measure of exposure because metro areas usually represent crowded regions which make transmission of a virus easy. During the Swine Flu Pandemic Hispanics and Blacks were known to live in metro/crowded areas (Quinn et al. 2011). Living in a metro area increases one's risk to exposure as these areas become hotspots during a pandemic; for example, during COVID-19 densely populated cities and surrounding metropolitan areas became hotspots with some of the greatest incidence and mortality (Zhang & Schawrtz, 2020). Living in such conditions is directly the result of housing location which is a social determinant of health. Minority populations who

lived in these metro areas increased their risk of exposure thereby leading to disparities in infection and mortality.

Inability to work from Home/Working in essential Industries. The inability to work from home prevents one from social distancing and avoiding exposure to a virus and it is therefore a strong measure of potential exposure. During the Swine Flu Pandemic many Hispanics reported the inability to work from home; as a result, this may have contributed to them experiencing disproportionate affliction and mortality (Quinn et al. 2011). The inability to work from home is related to occupation which is another social determinant of health. An individual's occupation will dictate whether they can work from home, and occupation further relates to a similar measure of exposure: working in essential industries. During COVID-19 minority populations were more likely to work in essential industries (Hawkins, 2020). Essential industries include healthcare positions that require one to be in close contact with individuals, processing industries, and animal slaughterhouses. Individuals who work in essential industries increase their exposure to viruses by being in close proximity to others. This further explains the observed trend in disparities noted amongst minority populations.

Living in an area with Greater Social Vulnerability. Another measure of exposure is living in an area with greater social vulnerability. The CDC developed an index that measures the social vulnerability of counties across the United States. It ranks counties using 15 census data social factors like poverty, crowded housing, etc. to determine vulnerability during a natural disaster (ATSDR, 2020). Social vulnerability is a good measure of exposure because it uses several social determinants of health to establish vulnerability. These social determinants of health are related to pandemics and include some of those identified earlier in the thesis. During

COVID-19, social vulnerability was associated with an increase in mortality due to COVID-19 (Kim & Bostwick, 2020), and areas of greater social vulnerability were also associated with the likelihood of a county becoming a hotspot (Dasgupta et al. 2020).

Living in Impoverished Communities. Living in impoverished communities is the last measure of exposure and is related to housing location. During COVID-19, a number of researchers found that living in an impoverished community increased ones' risk of COVID-19 mortality (Fielding-miller et al. 2020). Impoverished communities usually lack basic healthcare facilities and can become hotspots leading to many individuals contracting a virus. This was the case during COVID-19 when impoverished counties had significantly high infection rates (Adhikari et al. 2020; Rozenfeld et al. 2020). When impoverished counties are experiencing disproportionate infection and mortality this can put others at risk for contracting a virus.

Disparities in Susceptibility to Swine Flu and COVID-19

Disparities in susceptibility to Swine Flu and COVID-19 are those factors that increase one's risk of developing severe symptoms and disease after contracting the virus. Blumenshine et al. (2008) and Quinn et al. (2011) use chronic illnesses as a measure for one's susceptibility. The author when applying this model to Swine Flu and COVID-19 has adopted to use chronic illnesses and comorbidities as a measure of susceptibility because of the significant effects they can have on prognosis. Many factors such as COPD, immunosuppression, kidney disorders, and blood disorders can lead to complications if infected with Swine Flu or COVID-19 (Quinn et al. 2008 & CDC, 2021).

Being Diagnosed with a Chronic Illness or Comorbidity. A chronic illness is defined as a condition lasting one year or longer and requires ongoing medical attention (CDC, 2021),

and comorbidities are defined as the simultaneous presence of two or more medical conditions in a patient. During the Swine Flu pandemic possessing a chronic illness or comorbidity was associated with developing severe illness or even death (Quinn et al. 2011; Hennessy et al. 2015). Similar results were seen during COVID-19, counties with a higher proportion of individuals with chronic illnesses and comorbidities experienced greater mortality (Millet et al. 2020). Further studies note that during COVID-19 higher risk of mortality was associated with a number of chronic diseases including kidney and coronary artery disease (Yehia et al. 2020). It is not surprising that minority populations have a higher prevalence of chronic illnesses and comorbidities. This would explain why they are experiencing disproportionate affliction and mortality as diagnoses with a chronic illness is a measure of susceptibility.

Disparities in Treatment for Swine Flu and COVID-19

Blumenshine et al. (2008) uses access to healthcare as a measure of disparities in treatment. This analysis will also use access to healthcare and the ability to receive timely care as a measure of treatment. Access to healthcare is critical during a pandemic and can affect one's ability to recover if infected. Many minority populations lack health insurance and this infringes upon their ability to access timely care (Quinn et al. 2011).

Access to Healthcare and the Ability to Receive Timely Care. During the Swine Flu Pandemic delayed access to antivirals and healthcare was associated with increased risk for mortality (Hennessy et al. 2015). This delayed access may have contributed to minority populations experiencing disproportionate affliction and mortality. Access to healthcare is usually dictated by financial circumstances, therefore, those experiencing poverty are less likely to have regular providers. During the Swine Flu Pandemic a number of minority populations

reported lacking regular access to a healthcare provider (Quinn et al. 2011). Furthermore, during COVID-19 a greater proportion of cases was associated with populations who were uninsured (Millet et al. 2020). Individuals who are uninsured or lack a healthcare provider experience a barrier to accessing care. This has a significant effect on the experience of these individuals during a pandemic.

When applying this model to Swine Flu and COVID-19 it becomes very clear why minority populations are experiencing disproportionate affliction and mortality. When minority populations experience differences in social determinants of health, this leads to disparities on all three levels of the model as was noted during Swine Flu and COVID-19. As a result, minority populations form the majority of cases and hospitalizations leading to disparities in healthcare. It is therefore critical that social determinants of health are targeted and prioritized when planning for a pandemic.

Chapter Six: Solutions and Structural Change

The National Institute of Health (NIH) developed, in collaboration with other researchers, a COVID-19 pandemic vulnerability index (PVI) (Marvel et al. 2020 & National Institute of Environmental Health Sciences, 2021). This PVI maps out, using 12 different measures, the vulnerability of counties within the United States giving each county a score. Scores range from 0 to 1 with 0 being low vulnerability to COVID-19 and 1 being high vulnerability to COVID-19. Although this PVI is a novel tool, it is promising as it uses several of the measures of exposure, susceptibility, and treatment that were identified in the literature.

I believe that this PVI should be developed as a general index, and not specific to COVID-19, so that it may be used for future pandemic planning. This index can be used to target social determinants of health and disparities on the three levels mentioned in this thesis. By giving priority to counties that have a higher PVI we may be able to prevent disparities in infection and mortality as these counties are the most vulnerable. Priorities can include distributing medical supplies to these counties first, vaccinating them before other counties, or providing government sponsored PPE and testing to these areas. More research is needed in this area to identify whether these methods will in fact curtail the increasing Racial/SES disparities.

Chapter Seven: Discussions

Disparities in pandemics continue to affect our healthcare system and the root cause of those disparities are social determinants of health. Understanding how social determinants of health affect disparities in past and current pandemics is critical for future pandemic planning. As this thesis has shown, several social determinants of health were identified in the literature as having a role in leading to disparities during Swine Flu and COVID-19. By using the model of Blumenshine et al. (2008) I identified, from the literature, several social determinants of health that contributed to the disparities noted in both pandemics. I further hypothesized measures of exposure, susceptibility, and treatment that are related to the initial social determinants of health identified. Individuals who experienced disparities on these three levels eventually experienced the highest level of disparities in infection and mortality as was supported by the literature. This thesis builds on existing evidence for the importance of social determinants of health in determining outcomes during a pandemic, and it brings to light a number of factors that can contribute to disparities. Given that disparities can occur on several levels, a PVI that addresses all the levels identified and their respective measures should be developed. This PVI should be created not for one pandemic but as an ongoing project to plan effectively for future pandemics.

This thesis also includes several limitations. First, the literature review only included eight articles for the Swine Flu pandemic compared to twenty-nine for the articles on COVID-19. This discrepancy could be due to the fact that the effects of COVID-19 are world-wide representing an unprecedented pandemic. Therefore, there is a larger number of articles to work with when compared to Swine Flu as more researchers hope to study the impacts of disparities during COVID-19. Furthermore, as of this writing, COVID-19 is still impacting the globe one

year after its inception having a longer timeline than Swine Flu. Second, this review was conducted during the COVID-19 pandemic and questions regarding the final impact of disparities on minority populations are yet to be answered. However, it is unlikely that the results regarding the distribution of disparities will be any different. Finally, this review is not meant to establish causality, but rather to illustrate common themes of disparities that exist in the literature. Although these limitations exist, this thesis brings light to several possible causes for disparities and their implications on pandemic disparities.

Future research should focus on how to use the current PVI developed by the NIH to prevent healthcare disparities. For example, instead of administering vaccines to those 65 and older start by administering them to counties with a PVI score of 0.7 or higher. Researchers can then see if making this decision lowers disparities in affliction and mortality experienced by minority populations in these communities. Adjustments to the PVI should be made to make the PVI for general use and not specific to COVID-19. This way we can use it to prevent disparities in future healthcare crises. Lastly, once the COVID-19 pandemic has subsided, retrospective studies should be conducted to analyze the full impact of disparities on Racial minorities. There will be a plethora of literature published within the coming months to years and a follow up literature review should be conducted.

Chapter Eight: Conclusion

It has been over a decade since the Swine Flu pandemic touched the United States and it seems as though nothing was learned. Now, in 2021, we are dealing with COVID-19 and the same SDH's, the same disparities, and the same minority populations are being affected. I would think that after the Swine Flu Pandemic subsided, the United States healthcare system would have learned its lesson about pandemics and disparities. I would hope that retrospective analyses would have been conducted and measures put in place to prevent disparities in a future pandemic. Unfortunately none of this occurred and if it did occur then those in charge have failed. As evident by this thesis the same disparities and populations are being disproportionately affected by COVID-19. I think it is time to seriously assess ourselves as a country and rectify our healthcare system to be better prepared for the next pandemic. COVID-19 could have been worse, and we have no excuse to not prepare ourselves for the next healthcare crisis. The PVI is a promising tool but again I must emphasize the importance of practicality. A tool or index is useless if it sits on a website not commanding change and being used as a driving force for improvement. I hope that future research will be conducted regarding the new PVI, and that this research can be used to criticize the current healthcare system so that there can be actual change. Only when individuals are free to ask questions and raise concerns will we see a possibility for change. This needs to happen at the highest level of the healthcare system all the way down to the individual citizen.

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Appendix A

Swine Flu Literature Table

Year	Author	Title	Purpose	Methods	Significant Findings
2013	Levy et al., (2013)	Disparities in the severity of Influenza Illness: A descriptive study of hospitalized and non-hospitalized Novel H1N1 Influenza-positive Patients in New York City: 2009-2012 Influenza Season	Whether or not a patient was hospitalized during his or her 2009 H1N1 influenza illness. Socioeconomic status was measured using education and neighborhood poverty	Case-control	<ul style="list-style-type: none"> • People with less education were more likely to be hospitalized. • Individuals without a high school diploma were 32 times more likely to be hospitalized. • Individuals of lower SES seek care later.
2014	Soyemi et al., (2014)	Disparities Among 2009 Pandemic Influenza A (H1N1) Hospital Admissions A Mixed Methods Analysis	Looking at disparities in hospitalization rates among racial groups .	Mixed Methods	<ul style="list-style-type: none"> • Hospitalization for blacks and Hispanics was 2-3 higher when compared to whites. • Mortality rates higher for blacks and Hispanics when compared to whites. • Prevalence of comorbidities was higher for blacks and Hispanics when compared to whites. • Response to threat is based on one's perception of risk.

					<ul style="list-style-type: none"> Minority groups had less perception of risk.
2009	CDC	MMWR Deaths Related to 2009 Pandemic Influenza A (H1N1) Among American Indian/Alaska Natives-12 States, 2009	To assess the burden of disproportionate deaths in AI/AN populations.	Quantitative Study	<ul style="list-style-type: none"> AI/AN had a mortality rate four times higher than persons of other races combined. AI/AN have a higher prevalence of chronic illness like diabetes. Twice as likely to have unmet medical needs because of cost. Also have the highest poverty rate.
2011	Quinn et al. (2011)	Racial Disparities in Exposure , Susceptibility, and Access to Health Care in the US H1N1 Influenza Pandemic	First empirical examination of disparities in H1N1 exposure, susceptibility, and access to healthcare.	Quantitative study	<ul style="list-style-type: none"> Blacks and Hispanics are more likely to live in a metro area. Hispanics live in more crowded conditions. Most Hispanics do not have sick leave from work. Blacks and Hispanics reported difficulty in accessing childcare. Blacks and Hispanics are less likely to get vaccinated for influenza. 63.2% of Hispanics lacked a regular healthcare provider.
2014	(Placzek & Madoff, 2014)	Effect of Race/Ethnicity and Socioeconomic Status on Pandemic H1N1-Related Outcomes in Massachusetts	Investigate H1N1 outcomes by racial groups and SES.	Quantitative study	<ul style="list-style-type: none"> Hispanics and Blacks had the highest rate of influenza-like illness. Hispanics admitted to the ICU had the longest length of stay. 2/3 of those admitted were of the lowest SES. 63% of Hispanics and 43% of blacks admitted to the ICU were from the lowest SES.

2011	Truelove et al., (2011)	Comparison of Patients hospitalized With Pandemic 2009 Influenza A (H1N1) Virus Infection During the First Two Pandemic Waves in Wisconsin	Evaluate differences in outcomes during pandemic waves in Wisconsin.	Quantitative Study	<ul style="list-style-type: none"> • Hospitalization rates were highest amongst minorities in wave one. • Minority populations were severely affected during wave one and this gave them infection immunity which is why they had lower infection rates in wave two.
2011	Dee et al., (2011)	Racial and Ethnic Disparities in Hospitalizations and Deaths Associated with 2009 Pandemic Influenza A (H1N1) Virus Infections in the United States	To analyze racial and ethnic disparities in the 2009 H1N1 influenza virus.	Quantitative study	<ul style="list-style-type: none"> • Hospitalization was highest among blacks and Hispanics (10.9/100,000 and 8.2/100,000). • Cases were highest for AI/AN (32.7/100,000) then for Hispanics (30.7/100,000) followed by blacks (29.7/100,000).
2012	Ponnambalam et al., (2012)	Understanding the socio-economic heterogeneity in healthcare in US counties: the effect of population density, education, and poverty on H1N1 pandemic mortality	To understand why certain counties reported fewer cases than other counties.	Quantitative Study	<ul style="list-style-type: none"> • Swine Flu deaths are concentrated in counties low in population density, low in educational attainment, and in people over 65.

COVID-19 Literature Table

Year	Author	Title	Purpose	Methods	Significant findings
2020	Holmes et al., (2020)	Black-White Risk Differentials in COVID-19 (SARS-COV2) Transmission, Mortality and case Fatality in the United States: Translational Epidemiologic Perspective and Challenges	Identifying racial Disparities in cumulative incidence and mortality.	Quantitative study	<ul style="list-style-type: none"> • This article noted significant environmental and economic SDH that affect Black infection and mortality rate. • Increase in mortality amongst Blacks concerning population size, and Whites. • In selected states during the study period, Blacks accounted for a large percentage of mortality • In every state examined blacks had the highest percent fatality.
2020	Rossen et al., (2020)	Excess Deaths Associated with COVID-19, by Age and Race and Ethnicity- United States, January 26- October 3, 2020	Describe trends and patterns in excess deaths during the study period.	Quantitative study	<ul style="list-style-type: none"> • The largest amount of excess deaths during the study period occurred with Blacks and Hispanics. • Results are consistent with the disparities noted in infection and mortality
2020	Bassett et al., (2020)	Variation in Racial/ethnic disparities in COVID-19 mortality by age in the United States: A cross sectional study	Examine variation in age-specific COVID-19 mortality rates by race/ethnicity	Quantitative study	<ul style="list-style-type: none"> • Found an excess risk in COVID-19 death at all ages in all of the minority populations analyzed when compared to their Caucasian counterparts • COVID-19 mortality rate ratios were 7-9 times higher for the minority populations • Loss of life at younger ages for people of color • Findings support that people of color were dying at a younger age and at higher rates
2020	Rozenfeld et al., (2020)	A model of disparities: risk factors associated with COVID-19 infection	Analyzing sociodemographic and environmental variables associated with infection	Quantitative study	<ul style="list-style-type: none"> • Higher risk was associated with being Black, Latino, or Asian • Higher risk was associated with living in neighborhoods with financial insecurity. • Sociodemographic risk factors found.
2020	Rentsch et al., (2020)	Patterns of COVID-19 testing and mortality	Investigate testing and	Quantitative study	<ul style="list-style-type: none"> • Black individuals were more likely to be tested

		by race and ethnicity among United States Veterans: A nationwide cohort study	mortality in a United states healthcare system		<ul style="list-style-type: none"> • Minority populations (Black, Hispanic) were more likely to be tested positive. •
2020	Alsan et al., (2020)	Disparities in Coronavirus 2019 Reported incidence, knowledge, and Behavior Among U.S. Adults	Determine the association of sociodemographic characteristics with reported incidence, knowledge, and behavior regarding COVID-19	Quantitative study	<ul style="list-style-type: none"> • African Americans were more likely than White individuals to report being infected. • African American were more likely to know someone who tested positive. • Minority populations (African Americans and Hispanics) were less likely to have knowledge of how COVID-19 spreads. • Studied partisan divide and how it affects the spread of the virus. • African Americans were less likely to know about fomite transmission. • African Americans are more likely to leave their homes for work (working in the social sector inability to work from home etc.).
2020	Gold et al., (2020)	Race, Ethnicity and Age Trends in persons Who Died from COVID-19-United States, May-August 2020	Describe demographic and geographic trends in COVID-19 associated death	Quantitative study	<ul style="list-style-type: none"> • Deaths were disproportionate amongst Hispanics and Blacks given that they only represent a small number of the population. • The mortality rate increased ten percent for Hispanics in August.
2020	Moore et al., (2020)	Disparities in incidence of COVID-19 Among Underrepresented Racial/ethnic Groups in counties Identified as Hotspots During June 5-18, 2020-22 sates, February-June 2020	Examine county-level disparities in COVID-19 cases among racial/ethnic minorities	Quantitative study	<ul style="list-style-type: none"> • Disparities among Hispanic populations were identified in ¾ of hotspot counties. • African Americans were also disproportionately present in hotspot counties.
2020	Azar et al., (2020)	Disparities in Outcomes Among COVID-19 Patients in A large health Care System in California	To measure health disparities in COVID-19	Quantitative study	<ul style="list-style-type: none"> • African Americans were 2.7 times more likely to be hospitalized when compared to whites.

					<ul style="list-style-type: none"> • 52.5 percent of African Americans were hospitalized compared with 25.7 percent of Whites. • A higher number of African Americans were transferred to the ICU. • African Americans with COVID-19 lived in zip codes with lower income compared to all other racial/ethnic groups. • Those residing in low-income zip codes were more likely to be hospitalized.
2020	Hatcher et al., (2020)	COVID-19 Among American Indian and Alaska Native Persons-23 States, January 31-July 3, 2020	To assess the impact of COVID-19 among the AI/AN population	Quantitative study	<ul style="list-style-type: none"> • AI/AN had a greater incidence of COVID-19 in the 23 states analyzed • Incidence: 594/100,000 among AI/AN compared to 169/100,000 for White individuals (3.5 times that of white persons). • Data regarding the underlying risk factor for AI/AN infection rate could not be obtained because of a lack of data.
2020	Dasgupta et al., (2020)	Association Between Social Vulnerability and a County's Risk for Becoming a COVID-19 Hotspot- United States, June 1- July 25,2020	To examine associations between social vulnerability and hotspot detection and to describe incidence after hotspot detection	Quantitative Study	<ul style="list-style-type: none"> • Areas with greater social vulnerability with dense housing and racial minority groups were more likely to become hotspots. • Counties with higher social vulnerability (housing type, English proficiency, and transportation) had a higher probability of being identified as a hotspot. • The incidence in hotspot counties was 97/100,000 and incidence in non-hotspot counties was 27/100,000.
2020	Mahajan & Larkins-Pettigrew,	Racial demographics and COVID-19 confirmed cases and deaths: a correlational analysis of 2886 US counties	Conduct a nationwide analysis to examine COVID-19	Quantitative study	<ul style="list-style-type: none"> • A positive correlation between the percentage of African Americans living in a county and percentage who have COVID-19 in that county.

			and race on a country level		<ul style="list-style-type: none"> • The same was found for Asian Americans. • The opposite was found for White Americans.
2020	Goyal et al., (2020)	Racial and/ or Ethnic and Socioeconomic Disparities of SARS-Cov-2 Infection Among Children	Evaluating Racial disparities in infection among children	Quantitative Study	<ul style="list-style-type: none"> • Analyzed disparities in children. • Black and Hispanic children have higher rates of testing positive. • Higher rates of exposure in less socioeconomically advantaged households. • These results specifically for the youth mirror results found in adults.
2020	Rosenberg et al., (2020)	Cumulative incidence and diagnosis of SARS-Cov-2 infection in New York	Generating reliable estimates of cumulative incidence in New York State	Quantitative Study	<ul style="list-style-type: none"> • The highest incidence was amongst Hispanics, African Americans followed by Asians.
2020	Yehia et al., (2020)	Association of Race with Mortality Among Patients Hospitalized with Coronavirus Disease 2019 (COVID-19) at 92 US Hospitals	Evaluate the association of race in-hospital mortality for COVID-19 patients	Quantitative Study	<ul style="list-style-type: none"> • Black patients hospitalized were younger • More likely to have Medicaid (Black patients) • Mortality did not differ between Black and White patients • Greater Black patients had chronic illnesses and comorbidities (except for COPD and coronary artery disease)
2020	Cheng et al., (2020)	COVID-19 Death Rates Are Higher in Rural Counties with Larger Shares of Black and Hispanics	Comparing COVID-19 mortality rates by county in racial populations Specifically rural counties	Quantitative Study	<ul style="list-style-type: none"> • The average daily increase in COVID-19 mortality is higher in counties with Blacks and Hispanics • The counties with the largest COVID-19 mortality also have the largest Black and Hispanic population • COVID-19 mortality is not distributed equally in rural populations
2020	Hawkins, 2020	Differential Occupational Risk for COVID-19 and other Infection exposure According to Race and ethnicity	How occupational segregation according to race and ethnicity may	Quantitative Study	<ul style="list-style-type: none"> • Blacks are more likely to work in essential industries. Being in close proximity to others • Blacks and Hispanics are more likely to be employed

			contribute to COVID-19 risk		<p>in slaughterhouses (where outbreaks have occurred)</p> <ul style="list-style-type: none"> • Black and Asian workers were more likely to be employed in occupations with a high risk for infection
2020	Scannell et al., (2020)	Association Between County-Level Racial and ethnic Characteristics and COVID-19 Cases and Deaths in the USA	Understanding county-level racial characteristics and cases of COVID-19	Quantitative Study	<ul style="list-style-type: none"> • Counties with a higher proportion of Blacks had a higher number of cases and deaths • Did not find an association with Hispanic residents
2020	Zhang & Schwartz (2020)	Spatial Disparities in Coronavirus Incidence and Mortality in the United States: An Ecological Analysis as of May 2020	Investigate spatial patterns of COVID-19 in relation to socioeconomic variables that affect counties	Quantitative Study	<ul style="list-style-type: none"> • Large crowded cities are the hotspots of COVID-19. This is in terms of incidence and mortality • However, several rural counties showed a higher incidence and mortality than crowded cities
2020	Adhikari et al., (2020)	Assessment of Community Level Disparities in Coronavirus Disease 2019 (COVID-19) Infections and Deaths in Large US Metropolitan Areas	Examine the Association of neighborhood race and poverty with COVID-19 infection and mortality in urban counties	Quantitative Study	<ul style="list-style-type: none"> • In more impoverished counties those with more non-White populations had an infection rate 8 times that of counties with White populations • They also had a death rate more than nine times greater
2020	Holtgrave et al., (2020)	Assessing racial and ethnic disparities using a COVID-19 outcomes continuum for New York State	Find contributions to fatality and disease severity differences	Quantitative Study	<ul style="list-style-type: none"> • Used a COVID-19 outcomes continuum similar to HIV • Minority populations particularly Hispanics and Blacks experienced greater infection and mortality • Hospitalization was twofold higher for Blacks and Hispanics • For Blacks, there are disparities at every step of the continuum
2020	Millett et al., (2020)	Assessing differential impacts of COVID-19 on black communities	To describe racial disparities in COVID-19 infection and mortality	Quantitative Study	<ul style="list-style-type: none"> • Counties with higher Black residents had more COVID-19 diagnosis • COVID-19 deaths were higher in Black counties • Counties with a greater number of Blacks also had a greater prevalence of comorbidities, uninsured

					individuals, greater air pollution
2020	Price-Haywood et al., (2020)	Hospitalization and Mortality among Black Patients and White Patients with COVID-19	To Acquire more information on racial/ethnic differences in COVID-19 outcomes	Quantitative Study	<ul style="list-style-type: none"> Black patients had a greater prevalence of chronic illnesses Blacks had the greatest hospitalization rate The majority of those who died in the hospital were Black
2020	Wadhwa et al., (2020)	Variation in COVID-19 Hospitalizations and Deaths Across New York City Boroughs	To examine population characteristics and differences in testing, hospitalization, and deaths	Quantitative Study	<ul style="list-style-type: none"> Hospitalization and deaths were lowest amongst the most affluent borough
2020	Tenforde et al., (2020)	Characteristics of Adult outpatients and inpatients with COVID-19-11 Academic Medical Centers, United States, March-May 2020	To understand the demographic characteristics of patients with COVID-19 and risks for requiring hospitalization	Quantitative Study	<ul style="list-style-type: none"> Inpatients were less likely to be White In patients were more likely to have an annual income lower than 25,000 dollars A large number of inpatients were Black and Hispanic
2020	Kim & Bistwick (2020)	Social Vulnerability and Racial Inequality in COVID-19 Deaths in Chicago	To understand racial inequalities in COVID-19	Quantitative Study	<ul style="list-style-type: none"> The majority of deaths found were among African Americans Greater social vulnerability in segregated mainly Black communities in Chicago
2020	Selden & Berdahl (2020)	COVID-19 And Racial/Ethnic Disparities in Health Risk, Employment, And Household Composition	To find explanations for racial/ethnic disparities in coronavirus disease 2019 in hospitalization and mortality	Quantitative Study	<ul style="list-style-type: none"> Black and Hispanics are more likely to suffer from conditions the CDC associates with higher risk
2020	Adegunsoye et al., (2020)	Association of Black race with Outcomes in COVID-19 Disease: A Retrospective Cohort Study	To examine the association of race with COVID-19 infection outcomes	Quantitative Study	<ul style="list-style-type: none"> Blacks were more likely to be infected and hospitalized Found no difference in mortality between Black and non-Black individuals

2020	Fielding-Miller et al., (2020)	Social Determinants of COVID-19 mortality at the county level	To assess the association between COVID-19 mortality and certain populations	Quantitative Study	<ul style="list-style-type: none"> Residents living below the federal poverty line reported greater mortality
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