COVID-19 Investigated in Terms of Disparities: An Analysis of the Past, Present, and Future of Public Health in Illinois

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Abstract

As a relatively new topic, previous literature fails to address the relation of social determinants of health to COVID-19. By combining existing knowledge on previous epidemics, information on the role of social determinants of health, and data on COVID-19, conclusions can be made about the path going forward. Historically, nonpharmacologic interventions such as quarantine periods, face coverings, and social distancing have been used in epidemics such as the Spanish Influenza of 1918-19. In terms of social determinants of health, geographical location, educational level, and income level all play a part in the health of an individual. Rather than emphasizing personal decisions, health policy can be utilized to address social determinants of health and improve healthcare infrastructure across the country. By directing focus towards proactive, public healthcare rather than reactive, medical healthcare – a healthier society can be formed in a post-COVID world.

Keywords: COVID-19, health disparities, public health policy, pandemic, social determinants of health

COVID-19 Investigated in Terms of Disparities

Background

Little did the world know, January 29th, 2020 was the last day before the world changed – the public health sector has been transformed in a previously unrecognizable way ever since the World Health Organization declared coronavirus a public health emergency. COVID-19 has stricken even the most rural areas of the world and has changed the way governments respond to health crises, the way employers dictate sick leave, the way schools and universities operate, and the overarching view citizens hold in regards to the topic "public health." It is well-known that COVID-19 primarily affects older people and those with underlying health conditions such as obesity or cardiovascular disease. However, what is intriguing and beneficial to healthcare policy is how health disparities, specifically socioeconomic status and geographical location, and factors such as educational level have an impact on health status and disease susceptibility, specifically COVID-19.

In this study, coronavirus pandemic, or COVID-19, will be investigated alongside socioeconomic status, geographical location, and educational level of Illinois residents. COVID-19 emerged in late Winter of 2019 in Wuhan, China but rapidly spread to other areas of the world, especially Europe and the United States of America. As mentioned previously, the World Health Organization (WHO), which works with the United Nations to coordinate and support health efforts within the governments, declared COVID-19 a public health emergency on January 30th, 2020. Just 64 days later, the WHO announced that the world had reached 1,000,000 documented COVID-19 cases. COVID-19 is a highly contagious respiratory disease in which those infected can remain asymptomatic for up to 14 days. Therefore the disease can spread exponentially before anyone knows their infected. The most common symptoms are fever, cough, and fatigue, but more serious symptoms include loss of taste or smell, difficulty

breathing, chest pain, and loss of speech or movement. While there is no cure or specific treatment for the disease, the spread can be reduced by social distancing, wearing face coverings, and frequent hand hygiene measures. Those who are elderly or have underlying health conditions such as obesity or cardiovascular disease are at the greatest risk, but COVID-19 affects all ages and types of people. In addition, specific health factors are not the only aspects to consider with public health emergencies.

One factor to consider is the geographical location. Geographical location can have a significant effect on the prevention and treatment of diseases, as rural areas typically struggle with access and proximity to healthcare. COVID-19 accelerates this disparity, as testing sites are not as widely available, and rural access hospitals often have fewer ICU beds and ventilators, which is an important concern with treating COVID-19. In urban areas, population density directly impacts the ability to social distance – as the more people in an area, the ability to spread apart decreases.

Uniquely, education level plays a primary and inspiring role in healthcare. Higher education levels tend to lead to more secure employment opportunities, which often come with access to healthcare insurance. Furthermore, studies show that higher educated individuals earn higher incomes, have better support systems, more secure housing, better nutrition, and are less likely to participate in activities such as cigarette smoking or binge drinking. In regards to COVID-19, the factors associated with higher education levels put individuals at less risk for contracting the disease, as working from home or taking off work is more accessible.

Socioeconomic status, specifically income level, is another key factor in healthcare. Specifically, income level impacts healthcare disparities. Factors such as poor nutrition, inadequate housing, discrimination, stress, and poor healthcare access impact the health of

minority and disadvantaged populations. COVID-19 influences these populations at a higher rate, as the ability to social distance or work from home is more difficult, the ability to seek healthcare without health insurance is harder, and the higher rates of underlying issues such as cardiovascular disease place these populations at a higher risk level.

Through health policy, pandemic control protocols, disease response measures, and healthcare disparities can be addressed. In regards to public health, if an individual has ever held a job, received a vaccination, shopped at a grocery store, or visited a restaurant – then they are considered a part of the public that the industry serves. Therefore, public health policy is applicable and impacts nearly every individual in the United States and should address the variety of issues each individual faces. Pandemic control and response protocols can, and should, be unified across the country. Finally, healthcare disparities are continuously impacting the healthcare system in drastic and unfortunate ways. By addressing these issues through health policy, a quicker and more stable route to a healthier society can be created.

Undetermined Information

Although we know that certain ethnicities are more susceptible to disease, the origin of that knowledge is puzzling. As discussed previously, cardiovascular disease is a risk factor for more severe symptoms of COVID-19. Furthermore, African-Americans are at higher risk for hypertension (high blood pressure). Why is that so? Do social determinants of health play a role? One study shows the answer is yes. According to Thorpe et al., “When non-Hispanic whites and African Americans live in similar social settings, their health outcomes are much more similar than those found in national samples” (2008, p. 1609). Are there other physiological explanations for why minority populations are disadvantaged or is it purely explained by social determinants of health?

Another aspect of healthcare that is perplexing is why rural areas have worse healthcare systems. Data indicates 19% of the United States population resides in rural areas however, rural health systems only have 1% of the ICU (intensive care unit) beds (Davoodi et al., 2020). In a pandemic where ICU bed availability is used as a measurement for success in controlling disease, rural health centers are at an even bigger disadvantage. It is important to consider how rural health care in particular may be improved. Health policy will likely play a key role in any improvement strategies.

Research shows that if everyone were given the same socioeconomic opportunities, (education, housing, etc.), then health status would be relatively equal. This would indicate a public health issue instead of looking at the health behaviors of an individual. Thus, a greater responsibility needs to be placed on healthcare organizations and the government to address social determinants of health and create policies that tear down these barriers so that being a minority in the United States is no longer a threat to one's health.

Purpose of Research

This research aims to examine possible gaps within public health programs and healthcare policy, specifically in regards to the disparities shown through COVID-19. With this information, recommendations for changes to the Illinois Department of Public Health (IDPH) will be made in order to create a healthier environment for all. Although the epidemiological spread of COVID-19 and the associated health risk factors are known at this time, the full impact of health disparities on the pandemic is still unknown. Thus, this research proposes to analyze COVID-19 data alongside U.S. Census data to conclude on how geographical location, income levels and housing, and education levels play a role in the spread and impact of COVID-19. Through the research, the following questions will be addressed and supported:

- What similarities are present between COVID-19 and previous pandemic protocols?
- What, if any, associations are there between geographical location (rural versus non-rural) and COVID-19 cases?
- What, if any, associations are there between income level and COVID-19 cases?
- What, if any, associations are there between educational level and COVID-19 cases?
- How can healthcare policies be implemented or revised to improve the disparities within COVID-19 rates?

Summary

The coronavirus pandemic, or COVID-19, has altered the United States healthcare system and individual views on public health measures and will likely continue to do so for years to come. Health disparities have been accentuated and brought to national attention. Based on what we know about COVID-19, some changes in healthcare policy may be in order.

Methods and Limitations

For this research, both qualitative and quantitative data and information were used. As COVID-19 emerged in late 2019 and mitigated to the United States in early 2020, a full scope of the impact of COVID-19 on social determinants of health in Illinois counties was not available in qualitative literature quite yet. Therefore, quantitative data were used to supplement the qualitative research on social determinants of health and health policy regarding the need for improvement in the United States.

For the quantitative data component, information was compiled from 3 sources: the U.S. Census, the Centers for Disease Control and Prevention (CDC), and USA Facts. The U.S. Census was selected as the source for data on the demographic variables for Illinois as it also is available for each state and county in the United States. If this research was to be replicated for

another location, the method would still be the same. The CDC was utilized for data on COVID-19 cases as under the Department of Health and Human Services for the US Government, the CDC is the branch of government responsible for disease control. By using data from the CDC, the research can be recreated for any state in the US – not just Illinois. Third, USA Facts was used for a more complete image of the timeline of COVID-19 in the United States. While the CDC reported data on total cases, cases per 100,000 residents, and deaths, USA Facts provided daily totals for each county in the United States. Furthermore, USA Facts was determined to be credible as the CDC recognized the organization and utilized the data as well. In regards to rural or non-rural classification, a map from the Illinois Department of Health was utilized (IDPH, 2014). To utilize rural or non-rural classifications for other states, more information will be required.

After compiling data from the three main sources, variables were selected. From the US Census, the selected variables for each Illinois county included: population estimates from 2019, actual population from 2010, median gross rent, high school graduate or higher, bachelor's degree or higher, median household income, persons in poverty, persons without health insurance, and population per square mile (U.S. Census). The final stage of compiling the data resulted in the removal of population estimates and actual population – as the measures were difficult to compare – and median gross rent, as it did not apply to all residents. From the CDC, total cases, percent of state's cases, cases per 100,000, and total deaths were available for each county (CDC COVID, 2020). However, only the total cases and cases per 100,000 were utilized as the two measures were the most applicable to the research. Each aspect of the daily case totals from USA Facts was utilized – but for most figures, counties were combined into rural or non-rural totals (US Coronavirus, 2020).

After selecting the variables to use, data were separated into a Microsoft Excel workbook. In each of the graphs, COVID-19 measures were the dependent variables – as the variables were being observed to see the impact. The independent variable was selected to best fit the topic – either education, geography, or income. After identifying the independent and dependent variables for a specific graph, a new data set was created. Then, Microsoft Excel's "Chart" function was utilized to create either a line graph (if using daily case information) or a scatter plot graph (if using other data). After creating each graph, an appendix of figures was made to compare and contrast the relationship of each variable in an easier layout.

However, as with most data methods – there are limitations. For each component of data, the information is accurate as of October 1st, 2020. Since then, COVID-19 cases in Illinois have more than doubled – going from 293,231 cumulative cases on October 1st to 646,269 on November 21st (US Coronavirus, 2020). Furthermore, 2020 is the year for the US Census to be updated. However, as the US Census was still being completed as of October 1st, 2020 – it will not be published until after this research is submitted. Therefore, data from the US Census are approximately 10 years old.

Another limitation is the data method selected. For the purpose of concise, clear, and easy to read figures, a basic scatterplot with a trend line was selected for a majority of the figures. For a more complete and thorough understanding of the data, statistical measures such as correlation and regression should be used. In future studies, a recommendation is made to retroactively analyze COVID-19 after the pandemic is deemed over.

Discussion

By analyzing previous studies and research dating back to the 7th Century B.C., in conjunction with the ongoing data being reported on COVID-19, an approach to the future of public health policies can be formed. The historical data and patterns of previous epidemics in

the United States and pandemics across the world set the stage for methods of preventing and managing an emerging source with pandemic potential. However, as history shows – when such data and knowledge is ignored, mismanaged, or undermined – the results are catastrophic. In addition to historical epidemiological and public health data, the statistics and research on COVID-19 in Illinois, specifically how various demographic variables, such as income level, education level, and geographic location, contribute to the impact of the disease will be analyzed. While it is far too late to alter the opinions, behaviors, and perceptions of COVID-19, the health policy revision suggestions presented here aim to improve the future public health and governmental responses to mitigating the outcome of epidemics and pandemics.

Previous Pandemics

History

While many will compare COVID-19 to the Spanish Influenza Pandemic of 1918-1919, studies of similarly dangerous epidemics and pandemics date back to 430 B.C. with an outbreak during the Peloponnesian War. Over the course of time, epidemics and pandemics have occurred – from the Peloponnesian War in 430 B.C. to the Justinian Plague of 541 A.D. to the Fist Plague Pandemic in 1350 to the Third Plague Pandemic of 1855 to the 1889 Russian Flu Pandemic – and a common theme is travel. According to Bassareo et al., "As a general rule, the more the human beings became civilized —leaving agrarian life, building towns, forging trade routes to connect remote regions one another and fighting wars for supremacy— the more pandemics showed up" (2020, p. 635). This is prevalent with COVID-19 as the disease originated in China, but spread to other nations through travel, then community transmission.

Unfortunately, history tends to repeat itself. In 1377, the Black Death resulted in cities implementing isolation periods after travel, with consequences for noncompliance. However, the

punishments did not apply to those in the highest class of society, or elected officials. As seen with the Presidential Election of 2020, various examples show how the highest of government officials in the White House has failed to comply with the administration's policies. One notable example is President Trump – who tested positive for COVID-19 – did not isolate according to Centers for Disease Control and Prevention (CDC) guidelines which state one who is diagnosed with COVID-19 can be around others "after 10 days have passed since you had a positive viral test for COVID-19" (CDC Isolate if You Are Sick). It is much more difficult for governmental agencies to implement restrictions on individuals' lives if there is noncompliance with those instituting the policies.

Public Health Issues

Dating back to studies in the early 1900s, both infected patients and healthy nurses/doctors can be responsible for the transmission of illnesses. Alice Hamilton, a woman's rights activist and pioneer of occupational health, found that out of 50 nurses and surgeons caring for those with streptococci, 46 carried the organism – which led to 36 of those individuals spreading the disease through coughing, and 26 through speaking (Nakayama, 2020, p. 557). However, after Hamilton's colleague implemented a mandatory face-covering policy, the spread of asymptomatic infection was prevented and none of the nurses became sick (Nakayama, 2020, p. 557). Shortly after the publication of the strategy, the Spanish Influenza Pandemic of 1918 occurred. While major cities who were suffering from the epidemic attempted to curb the disaster through face-covering policies, issues arose with residents either improperly wearing the covering or removing the item completely (Nakayama, 2020, p. 558). Unfortunately, this situation is repeating itself again with the face mask policies, and the lack of enforcement, for

COVID-19. As history has shown, it tends to repeat itself if drastic measures are not made in which attempt to stop the repetition.

Another public health measure used in an attempt to prevent illnesses is vaccination. In 1947, Smallpox disappeared from the United States – which is the outcome of mandatory vaccinations against the disease. However, public health vaccination strategies are not one size fits all; they tend to leave out both adults and minorities – which make up a large population, therefore decreasing the likelihood of herd immunity. In 2018-2019, the vaccination rate for Seasonal Influenza was less than 50% - and was even lower for minority populations (Bibbins-Domingo, 2020, p. 2). Also, prior to the 1989-1991 Measles Epidemic, the campaign to vaccinate against measles was provided at inequitable rates between races/ethnicities. According to Dr. Kirsten Bibbins-Domingo, "During the 1970s, the gap in measles vaccination rates between minority and white children was as high as 18 percentage points" (Bibbins-Domingo, 2020, p. 1). Thus, the 1989-1991 Measles Epidemic in the United States resulted in minority children being presented disproportionately in case numbers. Based on these studies, it is naïve of one to assume herd immunity and the invention of a vaccination will eliminate COVID-19 instantly from the world – especially given the noncompliance of nonpharmacologic interventions currently being imposed (i.e. face mask policies and social distancing practices).

COVID-19 versus Seasonal Influenza

Originally, many compared COVID-19 to Seasonal Influenza. There are indeed similarities between COVID-19 and Seasonal Influenza in terms of risk factors. These include, but are not limited to, increased age, obesity, residence in nursing homes, and underlying conditions such as lung disease, cardiac disease, and kidney disease. Furthermore, as both diseases are spread through respiratory droplets, nonpharmacologic interventions such as

mandated face coverings, closures of public areas, and limited movement would drastically decrease the infection rates for either disease (Solomon et al., 2020, pg. E1). However, the similarities end there.

From an epidemiological or public health standpoint, the reporting methods for the two diseases vary significantly. Unlike COVID-19, Seasonal Influenza in the United States is not a reportable disease – unless it results in the death of a person under the age of 18. Additionally, comparing the two diseases draws attention to the inaccuracy of reports – yet further shows the drastic differences between the infection rates. Either the count of influenza deaths is annually overestimated, the count of COVID-19 deaths is greatly underestimated, or both statements are likely true (Faust & Rio, 2020, p. 1045). When comparing weekly counts, "these statistics on counted deaths suggest that the number of COVID-19 deaths for the week ending April 21 was 9.5-fold to 44.1-fold greater than the peak week of counted influenza deaths during the past 7 influenza seasons in the US, with a 20.5-fold mean increase (95% CI, 16.3-27.7)" (Faust & Rio, 2020, p. 1045). Therefore, the comparison of the two diseases is inaccurate.

From a clinical standpoint, the management approach, course of virus, guidelines, and diagnosis of COVID-19 differ greatly from Seasonal Influenza. According to Drs. Solomon, Sherman, and Kanjilal in "Influenza in the COVID-19 Era," the main differences between the two diseases are the characteristics of infectivity, the dynamics of symptoms, the case-fatality rate, and the available treatments (2020, pg. E1). First, COVID-19 is more contagious than Seasonal Influenza, and patients are most infectious in the 48-hour window prior to the beginning of symptoms (compared to the symptomatic stage being the most infectious for Seasonal Influenza patients). Second, symptoms usually peak in the first 3-7 days for Seasonal Influenza illnesses, whereas symptoms might not peak for 2-3 weeks with COVID-19. Third, the

case-fatality rate for COVID-19 is 0.25%-3.0%, compared to 0.1% for Seasonal Influenza. To convey the seriousness of case-fatality, imagine this example: if each current Indiana State University student contracted COVID-19, between 270-325 students could perish as a result. However, if each current Indiana State University student contracted Seasonal Influenza in the same year, that is approximately 100 fatalities. Thus, rather than saying "it's just the flu" – measures should be taken to combat both diseases – so that no one has to lose their life. Finally, the available treatments for both diseases differ. Unless in an emergency, there is virtually no treatment for COVID-19 as of October 2020. However, annually there is an influenza vaccine, and a sample of antiviral treatments for severe cases of Seasonal Influenza – as explained in "Influenza in the COVID-19 Era" (2020, pg. E1). While the differences seem minimal, the impact of comparing the two diseases is catastrophic as it undermines the authority of COVID-19 researchers, scientists, and public health professionals.

Social Determinants of Health

As explained in Healthy People 2020, which is a component of the U.S. Department of Health and Human Services, by addressing the social determinants of health, the lives of all can be improved. In regards to the impact of addressing social determinants of health, the American Public Health Association determined that income level, education level, race, and access to healthcare can account for a 15-year difference in life expectancy (Generation Public Health, 2020). Rather than focusing solely on access to medical care, the areas identified in the framework reflect social and economic opportunities, in addition to resources and support systems. The five key issues within the framework are economic stability, neighborhood and built environment, health and healthcare, social and community context, and education – which oversee a variety of social and physical determinants.

Geographical Location

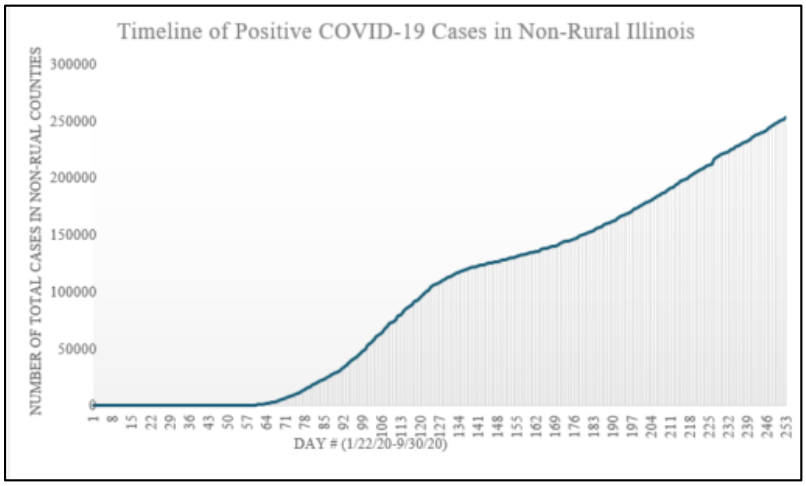
Geographical location, more specifically the classification of rural versus non-rural areas, impacts public health and health care in tremendous ways. Although it is not an identified social determinant of health in itself, it connects to each of the five areas and should be discussed first. In terms of characteristics, rural areas are challenged with fewer physician offices and/or a shortage of physicians and registered nurses, more residents without health insurance, a larger proportion of elderly populations and those with underlying conditions, less access to social services and mental health services, a greater lack of internet access, and lower incomes (Peters, 2020). Furthermore, in rural areas, health infrastructure is severely lacking. In Illinois, one metric used to represent the success of an area in controlling the spread of COVID-19 is the availability of Intensive Care Unit (ICU) beds. However, across the United States as a whole, only 1% of ICU beds are in rural areas (Davoodi et al., 2020). Additionally, pre-pandemic strategies of rural hospitals included transferring critically ill or injured patients to better-equipped facilities in suburban or urban areas. This approach to handling cases has been stifled by COVID-19, as suburban or urban healthcare facilities are facing overwhelming challenges of their own – such as a decreased capacity to take on cases from rural areas.

On the other end of the spectrum, metropolitan or urban areas are challenged with larger minority populations, which often are disproportionately impacted by underlying conditions and can add a language barrier to the list of challenges, a higher population density, and higher costs of living (Peters, 2020). COVID-19 has added challenges of social distancing, unemployment, and threats of eviction to many individuals' lives. In urban areas, the ability to social distance is decreased, unemployed individuals may face eviction, and language barriers may prevent access to healthcare. By addressing the differences in needs and population demographics between

various locations, public health and community health workers in addition to governmental agencies can target their efforts and resources on specific issues.

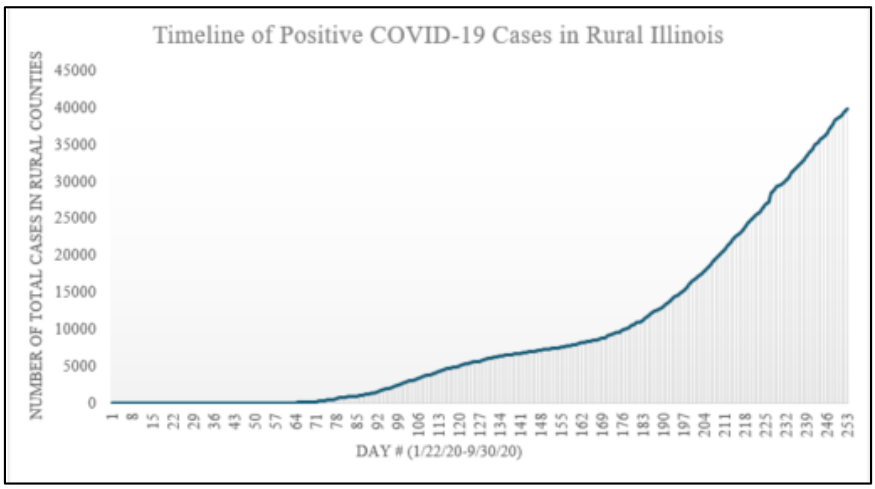
Initially, urban areas were targeted with COVID-19 relief efforts, as many assumed the higher populations and population densities would correlate strongly with more cases. However, as data from the Center for Disease Control and Prevention (CDC) has shown, 7 out of the 10 highest cases per 100,000 figures belong to rural counties in Illinois (CDC COVID, 2020). Hence, the factors and demographics of rural residents in regards to COVID-19 came to the forefront of this research. Various figures below illustrate the differences in the timeline, impact, and factors of geographical location and COVID-19.

Figure 1. Timeline of Positive COVID-19 Cases in Non-Rural Illinois



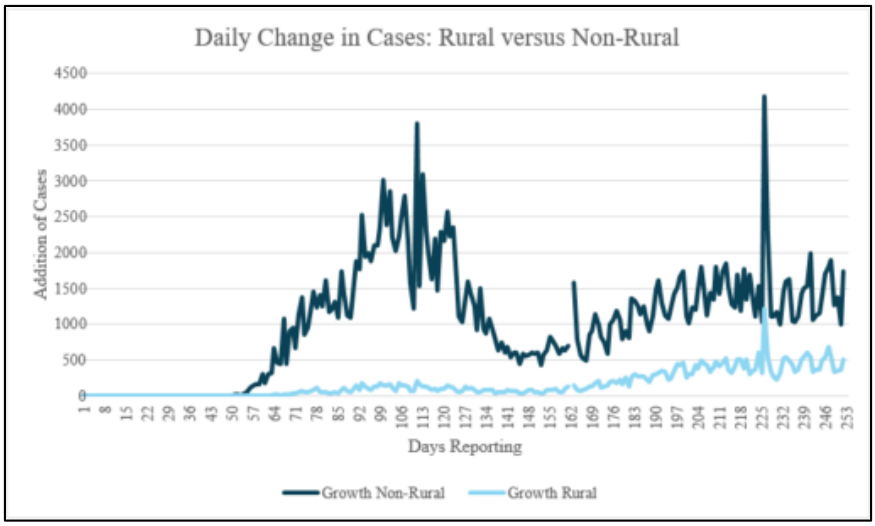
Note: The first positive case of COVID-19 in Illinois in a Non-Rural county occurred on Day 3. On Day 56, the first increase of cases greater than 100 was recorded. Cases rose steadily in the hundreds until the 76th day, where cases began to increase daily by 1000+. Between Days 137-168, the growth slowed, and Non-Rural counties in Illinois were reporting approximately 400-800 cases per day. However, the growth of cases increased once more and has been steadily rising by the thousands since Day 169.

Figure 2. Timeline of Positive COVID-19 Cases in Rural Illinois



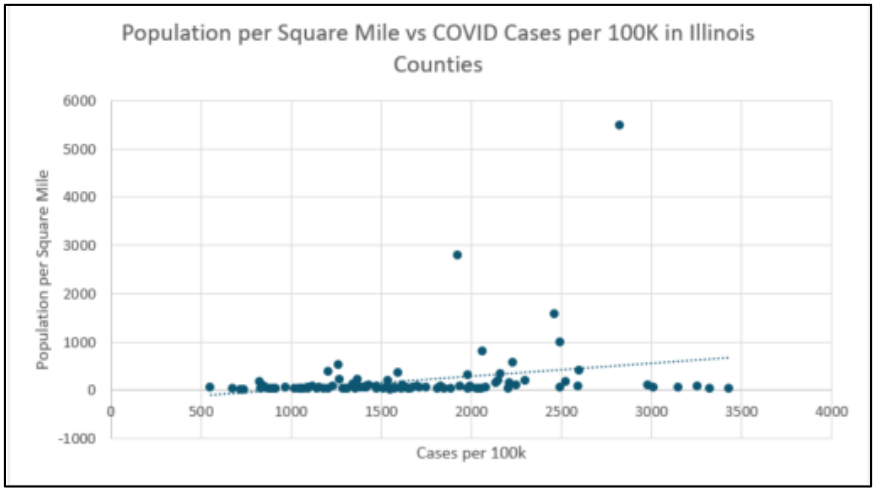
Note: The first positive case of COVID-19 in a rural Illinois county occurred on Day 48, which is 45 days later than a non-rural area. On day 90, cases began to rise steadily by around a hundred each day. This figure decreased and a plateau is shown between days 130-167 whereas cases were increasing by approximately 40-70 cases per day. However, an increase is shown as starting on Day 168, the cases once again began to increase by the hundreds. On Day 196, a steeper increase is shown – which coincides with the data that shows the growth of 300-500+ cases per day.

Figure 3. Timeline of Daily New Cases: Rural versus Non-Rural Illinois



Note: This graphic depicts the written explanation of Figures 1.A. and 1.B. at the same time. As shown, Non-Rural areas of Illinois saw the "first-wave" of COVID-19 sooner. Due to a reporting error, there is no data for Day 162 which could explain the peak of cases on Day 163. Thus, a clear "second-wave" cannot be explained, but both Non-Rural and Rural areas saw a spike in case growth near Day 225.

Figure 4. Population per Square Mile versus COVID-19 Cases per 100K in Illinois



Note: As shown in Figure 1.D., nearly all of Illinois has a population per square mile of below 1000. As Illinois is unique with having a major metropolitan city (Chicago), this figure has an extreme outlier.

In brief, both Rural and Non-Rural areas of Illinois have been impacted by COVID-19. Each county has its unique challenges in regards to mitigating the spread of the pandemic. Public health professionals must hone in on the differences between counties in order to create plans and provide resources. However, one limitation of comparing geographical data would be that researchers should be cautious of comparing case figures such as daily case counts as it could provide a false sense of security to rural residents (Peters, 2020) For example, in Illinois a rural county may think that community transmission is not occurring in their county as badly as it is in Chicago where cases are rising by the thousands daily, compared to an increase in the tens in a rural county. Finally, population density should not be seen as the most important figure in determining the risk of community transmission. Various other qualitative and quantitative factors including community sociability, occupational environments, and living quarters play a role in the risk of community transmission.

Educational Level

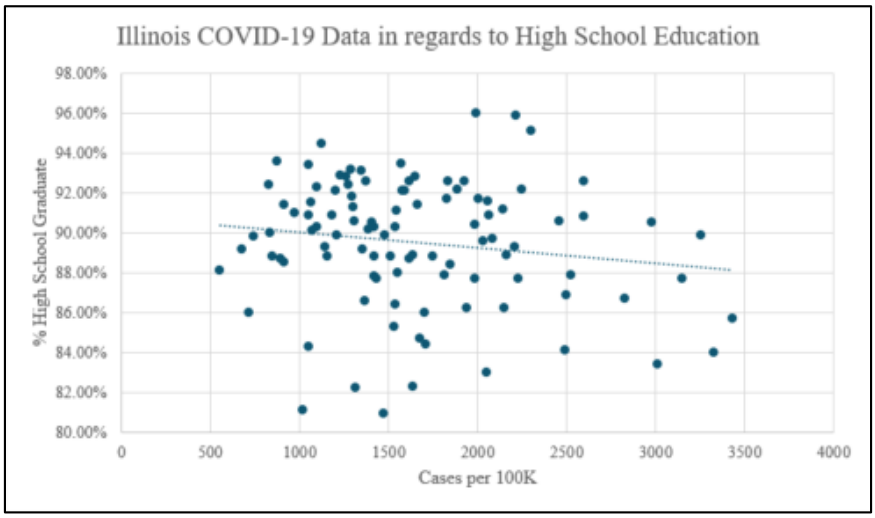
A second component of the social determinants of health that has been highlighted by COVID-19 and the research presented is education. As mentioned in *Journal of Public Health Management and Practice*, "Educational attainment is linked with health through 3 major interrelated pathways: health knowledge and behaviors; employment and income; and social and psychological factors, including a sense of control and social support" (Qu et al., 2016, p. E48),. While many would think of education only impacting the accessibility to jobs, it also impacts the risk of underlying conditions for COVID-19 such as cardiovascular disease via knowledge of healthy behaviors and degree of health literacy. Furthermore, the availability of occupations stemming from education impacts the ability to work safely during a pandemic, the ability to social distance (ex. using public transportation versus working from home), the ability to provide care for children who are no longer able to physically attend school or daycare, and access to health insurance. Finally, educational level also affects support systems which is another component of the social determinants of health.

The inequalities of education are not only accentuated by COVID-19; the inequalities have been present for too long and play a role in the daily lives of many. As explained in 1995 by "The Links Between Education and Health," those with a college degree are employed at a rate 10% higher than those with only a high-school degree. Also, college graduates are 1/5 as likely to be unemployed as those with some high-school (Ross & Wu, 1995, p. 721). Furthermore, the article continues to explain the impact of higher education: less likely to be unemployed, more likely to have a full-time, fulfilling job, higher income, lower economic hardship, higher sense of control and support, more likely to exercise, more likely to seek

preventative medical care, and less likely to smoke (Ross & Wu, 1995, p. 720). As one can see, the disparities are unfortunately similar 25 years later.

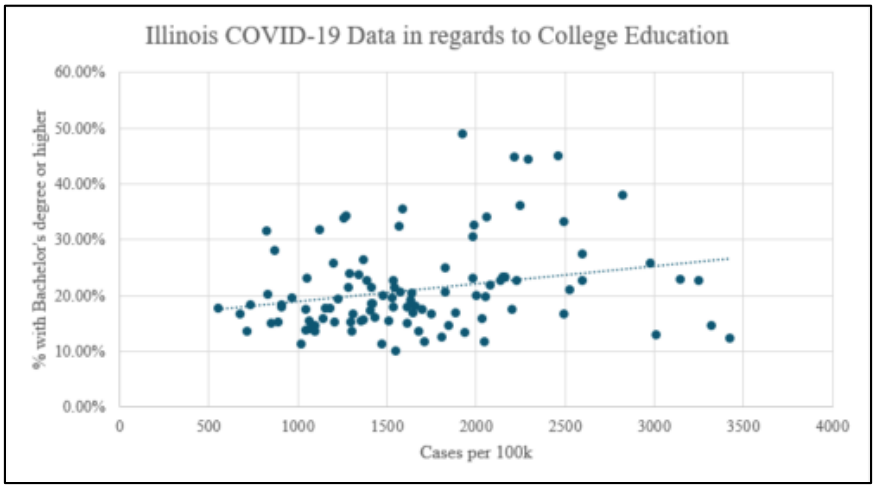
In addition, the educational disparities contribute to other disparities in health care – such as racial disparities. As hypothesized in *Racial Disparities in COVID-19 Mortality Among Essential Workers in the United States*, mortality rates among black persons are higher than non-Hispanic white persons due to the differences in rates of essential worker positions (Rogers et al., 2020, p. 312). In regards to specific categories, both Black and Hispanic populations are represented at higher rates than White populations in the industries of transportation, food service, maintenance, and production. Therefore, Rogers et al. concluded that, "Our findings confirmed our central hypothesis that COVID-19 mortality was highest among NH [Non-Hispanic] Blacks compared with NH [Non-Hispanic] Whites due to NH [Non-Hispanic] Blacks holding more essential-worker positions." (Rogers et al., 2020, p. 319). Once again, racial minorities are at an unfortunate disadvantage. Inspired by the lack of available studies, the graphics presented in Figures 5 and 6 represent the data that was combined to depict the impact of educational level on COVID-19 data in Illinois.

Figure 5. Percentage of High School Graduates versus Cases per 100K



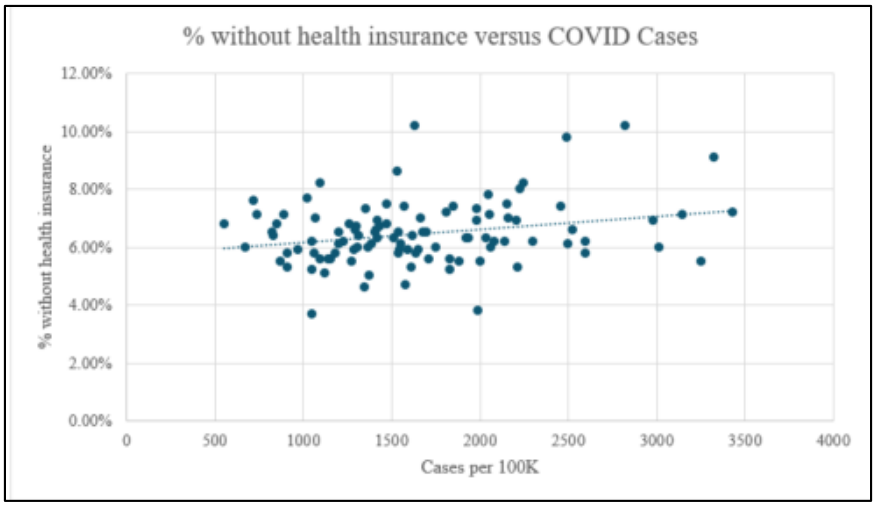
Note: The figure represents the percentage of high school graduates versus cases per 100K in Illinois. The trend line depicts how as the rate of graduates decreases, the count of cases per 100k increases.

Figure 6. Percentage with Bachelor's Degree or Higher versus Cases per 100K



Note: The figure represented here shows a trend line of when the percentage with a Bachelor's degree or higher increases, so does the number of cases of COVID-19 per 100K in Illinois. This is inconsistent with the findings from previous studies, so more information is needed to draw a conclusive argument.

Figure 7. Percentage without health insurance versus COVID-19 Cases per 100K



Note: While not directly related to education, the information presented previously shows how health insurance is connected to higher educational levels. The figure presented shows how as the percentage of individuals without health insurance increases, as does the number of cases per 100K.

Interestingly, the amount of conclusive studies and articles surrounding the data on the relationship between educational level and disease infectivity, more specifically COVID-19, was worrisome as to how impactful educational level is in terms of social determinants of health. However, connections can still be drawn – as the data shows as the rate of high school graduates decreases, the impact of COVID-19 increases. As mentioned in the literature, essential worker positions are oftentimes in industries such as transportation and maintenance – not administrative occupations. In future studies, the impact of virtual elementary education on high school graduation and college graduation rates in current adolescents would be intriguing.

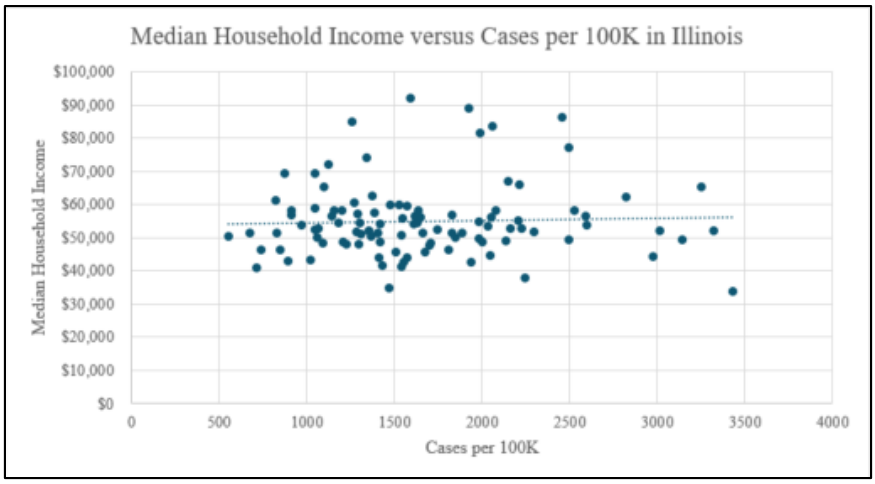
Income Level

As the literature has shown, social determinants of health are interconnected and it is difficult to explain exactly the impact of one alone. In regards to educational level, the impact of income was discussed briefly. Another common theme presented is how COVID-19 has magnified disparities in the United States. This section aims to investigate deeper into the connections of income level and COVID-19 in Illinois counties.

As explained by Adler et al. (2016), "People in less-advantaged groups have worse health from the moment of birth and throughout life. For example, a 40-year old American man in the poorest 1% of the income distribution will die an average of 14.6 years sooner than a man in the richest 1%" (p. 2). This aligns closely with the American Public Health Association's prediction of lifestyle characteristics resulting in a loss of up to 15 life years (Generation Public Health, 2020). In a typical year with "normal" conditions, this would be a problem. In 2020 with the COVID-19 pandemic impacting the economy, health system, and lives of nearly every single individual – the income disparities are catastrophic. As with education level, the lack of studies and graphics was interesting – which inspired the studies below

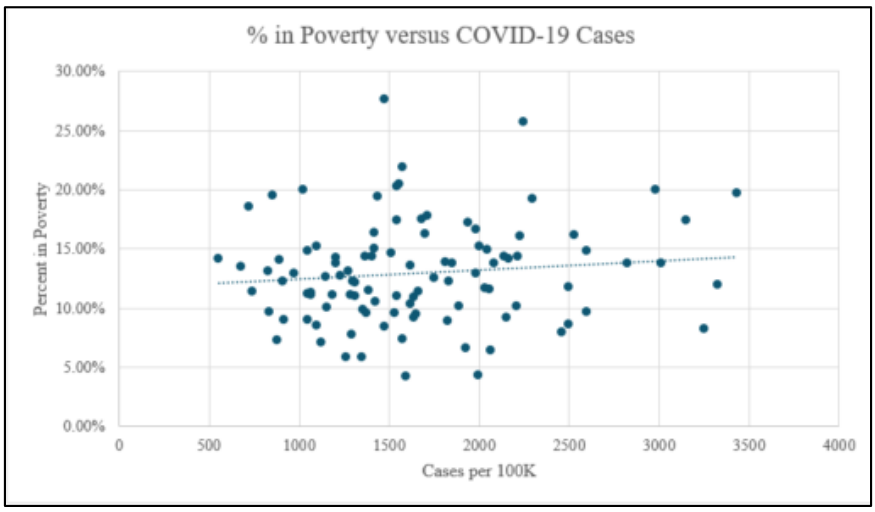
Previously discussed, the disadvantage of minority populations is a common theme in the disparities of social determinants of health. Investigated in *The Disproportionate Impact of COVID-19 on Racial and Ethnic Minorities in the United States*, poverty impacts different minority groups at disproportionate rates. Before COVID-19, 24% of Native Americans, 22% of African Americans, and 19% of Hispanics were considered to be in poverty compared to just 9% of whites (Tai et al., p. 2). Furthermore, Tai et al. explains that "the median wealth of white households is 10 times the wealth of African American households" (Tai et al., p. 2). Thus, once again minority populations are at an even further disadvantage.

Figure 8. Median Household Income versus COVID-19 Cases per 100K In Illinois



Note: Surprisingly, the median household income did not show a steep trend line when compared against COVID-19 cases per 100K. Perhaps, a better estimation would be the occupational industry compared to the COVID-19 rates – as different industries have variations in the risk of exposure.

Figure 9. Percentage in Poverty versus Cases Per 100K in Illinois



Note: In this figure, the percentage of individuals in poverty is compared against the number of cases per 100K. The positive slope of the trend line indicates that as the poverty rate increases, so does the amount of cases – which is in line with what has been discussed.

As mentioned previously, those with lower educations are more likely to earn a lower household income. Furthermore, those with a lower education might be placed at a higher risk for COVID-19, as many of the essential industries the individuals work in have limited ability to work from home or have limited interactions with others. In addition to the occupational conditions, those with lower incomes also are at an increased risk for COVID-19 due to worse housing conditions, the ability to seek preventative healthcare, and the increase of stress which increases the risk of cardiovascular disease, an underlying condition for COVID-19 (Patel et al., 2020). While the figures shown above did not represent the drastic trend lines that were expected, the figures also do not take into account all of the variables of socioeconomic status. Other factors must be considered – as those with higher incomes might live in counties of higher population density (such as a metropolitan city), or work in healthcare occupations. Further studies and analyses will need to be done to draw more definitive conclusions on the impact of socioeconomic status on COVID-19.

Public Health Policy

Quarantine & Isolation Restrictions

Despite what media outlets, controversial government officials, and health illiterate individuals may say – the policy of quarantining (and the associated consequences for noncompliance) is not a new concept. Dating back to the 7th Century B.C., cities, states, and governments have been utilizing the approach to separate infected individuals from non-infected, in an effort to curb whichever illness is present at the time. However, rather than the 10-14 day quarantine/isolation period for COVID-19, previous pandemics imposed a 30-40 day lockdown. While protestors attempt to prove that imposing state or nationwide quarantine restrictions are unethical and illegal, legislation proves otherwise. In the United States, the National Quarantine Act was passed in 1878 – which legally granted the federal government (not individual states) the power to quarantine individuals who may have a specified infectious disease.

Currently, there are 20 quarantine stations throughout the United States being utilized for isolating individuals. Listed in the Executive Order, quarantinable diseases including "severe acute respiratory syndromes and new types of flu (influenza) that could cause a pandemic" (U.S. Quarantine, 2020). Therefore, the United States legally requires individuals to quarantine during the COVID-19 pandemic, as they did in the Spanish Influenza Pandemic of 1918-1919. Furthermore, it is both dangerous and irresponsible to not comply with government directives in emergencies – as the risky behavior jeopardizes the health of the entire country.

Vaccination Laws & CDC Reputation

In regards to more recent public health policies, the rulings on vaccination laws are relevant for the discussion of COVID-19. While many are seeking the creation of a COVID-19 vaccination to end the pandemic restrictions and allow the world to return to its normal state, that

brings a large concern to the public health field. In 1976, United States President Ford attempted to quickly roll out a massive vaccination campaign to prevent a pandemic of a new virus – a strain of influenza nicknamed Swine Flu (Richards, 2010). However, the rushed creation of the vaccination led to questions about the safety, which led to a decrease in the credible reputation of the Centers for Disease Control and Prevention (CDC). Following this incident, the CDC has taken a "risk adverse" position in the United States.

In regards to vaccination laws themselves, there is little political policy enforced for strict, mandatory vaccination laws, especially for adults. In most, if not all cases, adult vaccinations are voluntary – unless required by an employer; even so, many employees, including healthcare employees, will refuse vaccinations for various personal reasons (Richards, 2010). Furthermore, the term "herd immunity" implies that an overwhelming majority of the population is vaccinated. Healthy People 2020 had a goal of 70% of the US population receiving the widely available influenza vaccine – but fell short with achieving only 45.3% (Bibbins-Domingo, 2020). Without adequate vaccination coverage, it will be nearly impossible to achieve herd immunity for COVID-19.

Finally, a 2008 study published in *Health Promotion Practice* shows that out of many public health measures and policies set by the government, individuals are least likely to support a vaccination campaign that is not fully approved (Paek et al., 2008). The article referenced states that individuals would be likely to support measures ranging from quarantining exposed individuals to closing stores, schools, churches, airports, and limiting car traffic, but oppose offering vaccines or drugs that are not fully approved. When taking the public's reaction to measures implemented in 2020 such as closing churches and recommending quarantine, the chances of vaccination support look bleak. By combining the factors explained, the chances that

a successful and safe COVID-19 vaccination campaign reaches an overwhelming majority of the world's population is slim to none in the next few years.

Areas of Improvement

The United States of America would not be nearing 10 million cases of COVID-19 if the government would have adequately prepared for the pandemic that was eventually going to come. Near the beginning of the emergence of COVID-19, individuals were skeptical. Combine this with a United States election year – and the media jumped on the opportunity to appeal to a variety of opinions. As mentioned in an article published in *Health Promotion Practice*, healthcare professionals must provide clear, consistent, and accurate messages to individuals in order to educate the population without disseminating fear or alarming people (Paek et al., 2008). However, the United States government, media outlets, and local health departments failed to form a united front in the beginning. This was even further escalated by the downplaying of the virus by the 45th Presidential Administration. Trump himself tweeted that COVID-19 was similar and less lethal than Seasonal Influenza ("Morally Reprehensible" 2020). Unfortunately, that single social media outburst was not all Trump did to damage the control of COVID-19.

Second, the United States of America cannot expect to change the attitudes of citizens, companies, and policymakers overnight. Although the United States annually suffers from an influenza epidemic, public health knowledge and policies rarely are widespread or enforced strictly. Therefore, immunization protocols, the culture of hand hygiene, union contracts, sick leave policies, and personal habits and beliefs reflect the lack of significant public health policies in regards to epidemics in recent years (Richards, 2010). By expanding the Family Medical Leave Act (FMLA) to address paid sick leave, employers can create a healthier organization and provide care for their employees to help prevent the spread of disease. Moving forward, the

societal view of epidemics will need to change – or there is a greater risk of the events of 2020 repeating.

However, many will ask how these policies will be funded. When discussing the improvement of healthcare across entire populations – public health interventions need funding, not solely medical care. By focusing more on preventing disease, costly end of life care measures can be reduced. Although the United States spends more on healthcare than any other country, only 5% of the spending is allocated to public health agencies and programs (Mays & Smith, 2010). However, many studies have shown the long-term impact of investing in public health programs. For example, cardiovascular disease is oftentimes prevented through lifestyle changes such as quitting smoking, eating a healthy diet, and exercising regularly. On the contrary, cardiovascular disease is still the leading cause of death in the United States and costs approximately $219,000,000,000 annually in medical and healthcare services ("Heart Disease" 2020). In one study, the effect of increasing public health spending by 10% was measured. The results included decreased infant mortality and decreased deaths due to heart disease, diabetes, cancer, and influenza (Mays & Smith, 2010). By redirecting healthcare spending and increasing public health program funding, preventable deaths can be reduced.

Conclusion

In conclusion, COVID-19 has altered the world for years to come. Over 1 million lives have been lost, including over ¼ of a million in the United States alone. However, it is not the first pandemic that has swept across the world and is unlikely to be the last – unless drastic changes are made to differentiate future disease paths from the route of COVID-19 and previous diseases of pandemic potential. In previous pandemics, ranging from the one during the Peloponnesian War in 430 B.C. to the Spanish Influenza Pandemic of 1918-1919, nonpharmacologic interventions such as face coverings and quarantine/isolation periods were

utilized. When modern medicine techniques such as the rapid creation of vaccination fail to mitigate the spread of a pandemic, historical inventions can still be utilized.

While many compared COVID-19 to the Spanish Influenza, it was also oftentimes compared to a version of the Seasonal Influenza, as symptoms and transmission methods were vaguely similar. However, this comparison is inaccurate as COVID-19 has a longer incubation period, more severe symptoms, and has a higher fatality rate. By undermining the impact of COVID-19, lives have been lost that could have been prevented.

In regards to social determinants of health, or variables that impact the way one works, lives, and plays, three categories were highlighted in this research. First, the geographical location was selected as it is the foundation for which anyone lives. It is unavoidable to be impacted by location. In regards to COVID-19, the disease has touched even the most rural parts of the United States. Due to differences in healthcare infrastructure, disparities in the population characteristics, and community factors, each county in Illinois has its own, unique set of challenges highlighted by COVID-19.

Concerning healthcare infrastructure, rural areas are at a bigger disadvantage. As touched on in the research, there is an extreme imbalance in the availability of ICU beds. Furthermore, strategies of healthcare in rural areas might include transferring critical patients to nearby facilities in urban areas that are better equipped to handle the severity of a case. There is also a shortage of physicians and nurses in rural areas. Thus, the components combined lead to a large disadvantage for residents of rural areas during COVID-19. In regards to nonrural areas, improved healthcare systems cannot make up for the population characteristics. Urban areas are impacted by higher rates of minority populations, which unfortunately are at greater risk for underlying health conditions such as cardiovascular disease. In conjunction with higher

population density, nonrural or urban areas are facing their own set of challenges with COVID-19.

The second disparity addressed was education level. The degree to which an individual is educated is related to the access to and qualification for jobs, the knowledge and application of healthy behaviors, and the ability to decipher health information. Literature has shown that individuals with higher education levels are more likely to have a secure job that provides health insurance, a stable income, and a support system – which relate to social determinants of health and the ability to be a healthy person. Data on COVID-19 in Illinois reflected the previous knowledge as it was shown that as the percentage of individuals with a high school degree decreased, the amount of COVID-19 cases increased. Furthermore, the first disparity, location, is prevalent in education as well. On average, the rate of individuals in rural areas with a bachelor's degree is 10% less than that of nonrural areas.

The third disparity addressed was socioeconomic status – specifically income level. As mentioned previously in regards to occupations, a higher and more stable income relates to health in many ways. This ranges from access to gym memberships and fresh organic produce to preventative healthcare and transportation to specialty physicians. However, COVID-19 has accentuated the racial disparities in regards to socioeconomic status as well as unemployment issues. Poverty rates are disproportionate to the makeup of the United States populations, with minority populations being at a disadvantage. Furthermore, COVID-19 has shown the impact of unemployment on healthcare – as insurance is oftentimes dependent on a stable job. However, income level itself is difficult to address as it plays a vital role in many other determinants of health.

Finally, the issues regarding health policies were addressed. Moving forward, changes must be made – or 2020 will likely be repeated. The United States can no longer place health status on the shoulders of individual behaviors and instead must address public health concerns and social determinants of health from a governmental perspective. While individual behaviors play a role in health, disparities have shown that not all individuals have the ability or access to make such decisions on their own. Prior to COVID-19, several governmental actions and individual beliefs set the United States up to fail during a pandemic. From workplace culture to the 1976 Swine Flu outbreak, previous decisions have led to the uncoordinated and individualized response to COVID-19. In regards to healthcare costs, redirecting spending to focus more on public health programs has been proven to reduce preventable deaths.

In brief, COVID-19 has unfortunately uncovered a variety of issues regarding healthcare in the United States and has accentuated existing healthcare disparities. However, it has also highlighted and proven the work of public health professionals to be necessary and valuable. Through both qualitative and quantitative data, the impact of COVID-19 on location, education, and income was shown in Illinois and can be generalized for most of the United States using the same methods and literature. Future studies will illustrate further the scope and timeline of the impact of COVID-19, and it is certain to be worse if measures are not put in place to control the impact – both epidemiologically and socially.

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Appendix A

Figure 1. Timeline of Positive COVID-19 Cases in Non-Rural Illinois

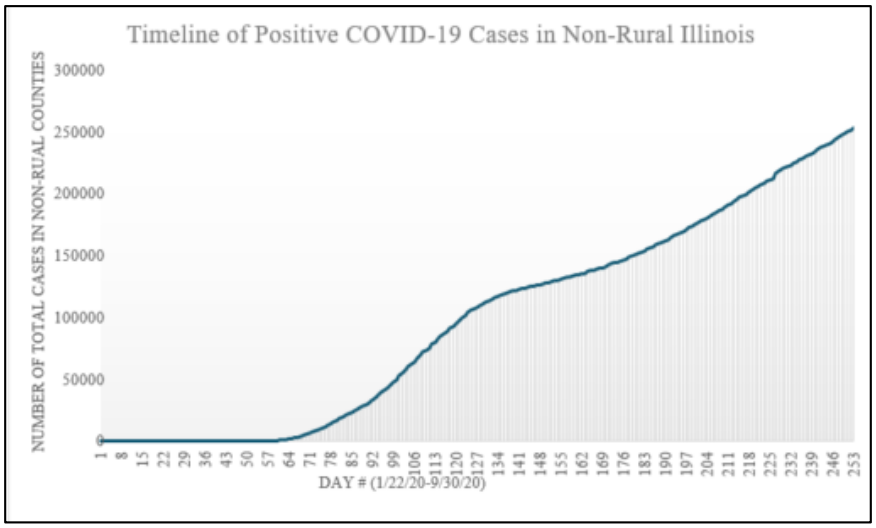


Figure 2. Timeline of Positive COVID-19 Cases in Rural Illinois

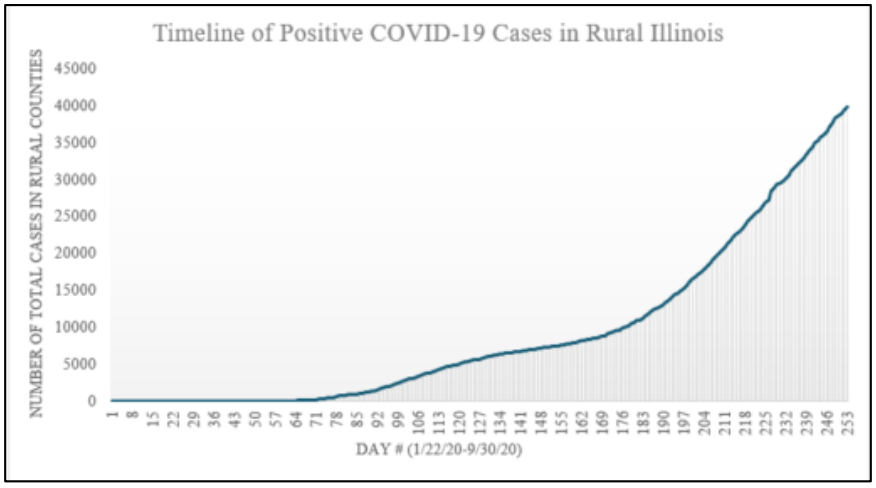


Figure 3. Timeline of Daily New Cases: Rural versus Non-Rural Illinois

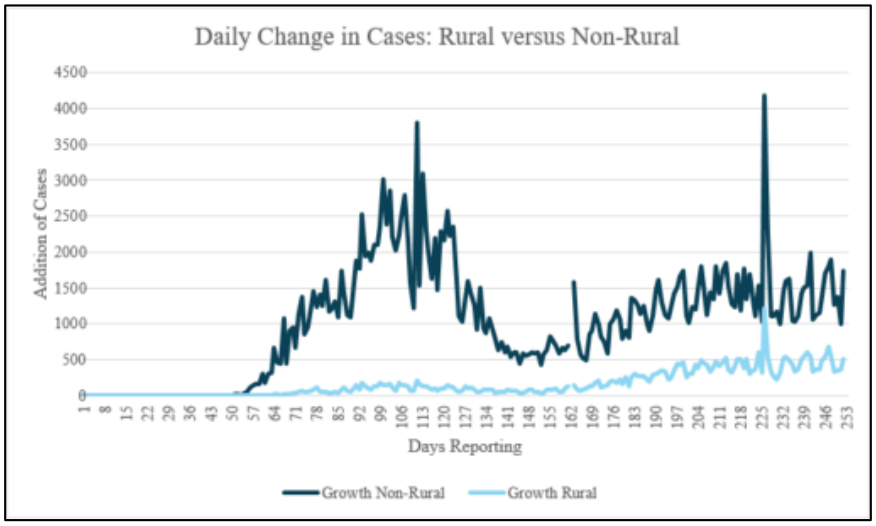


Figure 4. Population per Square Mile versus COVID-19 Cases per 100K in Illinois

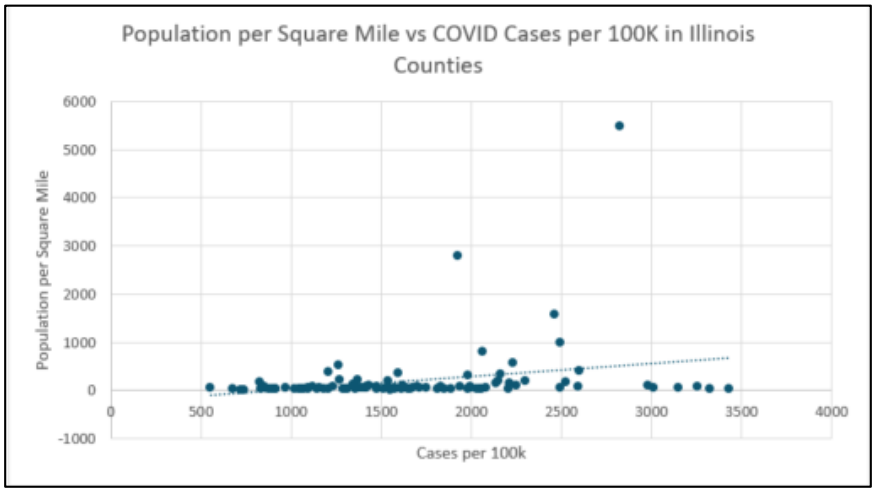


Figure 5. Percentage of High School Graduates versus Cases per 100K

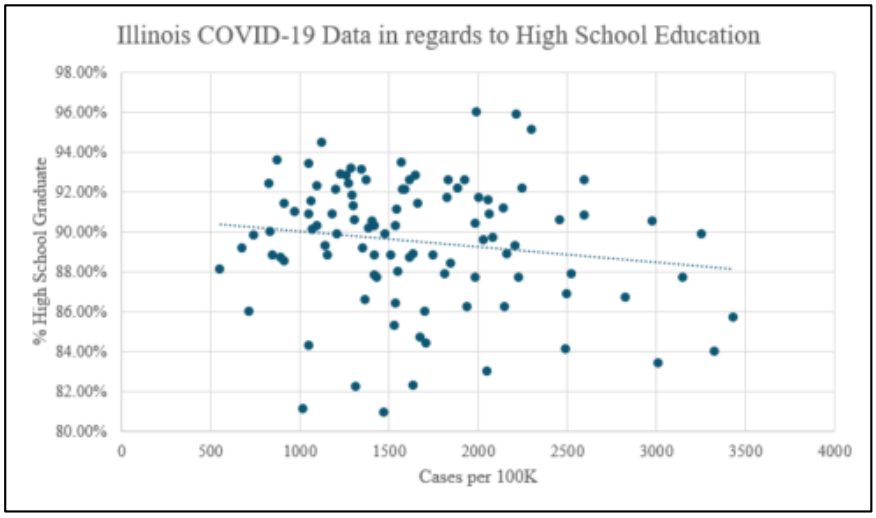


Figure 6. Percentage with Bachelor's Degree or Higher versus Cases per 100K

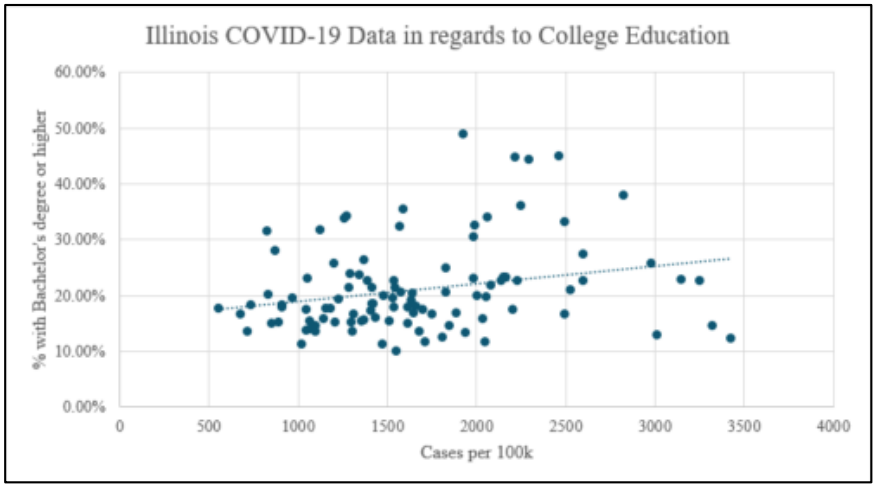
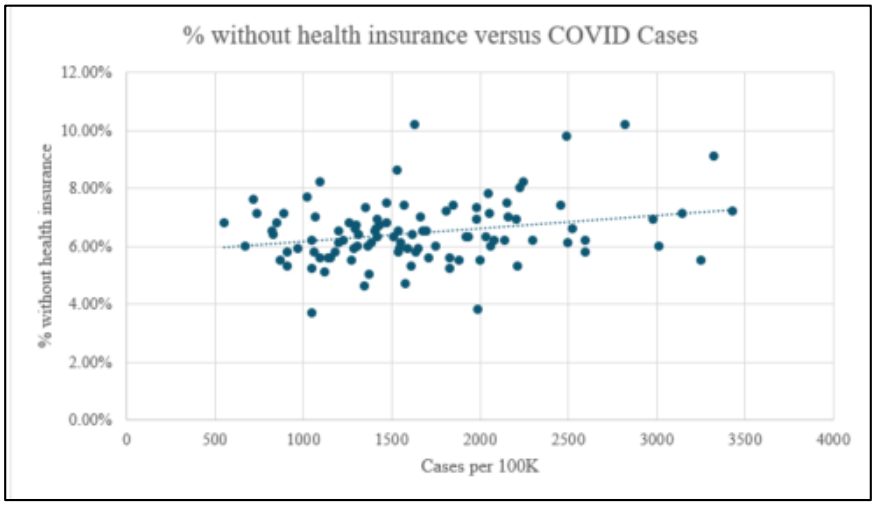


Figure 7. Percentage without health insurance versus COVID-19 Cases per 100K



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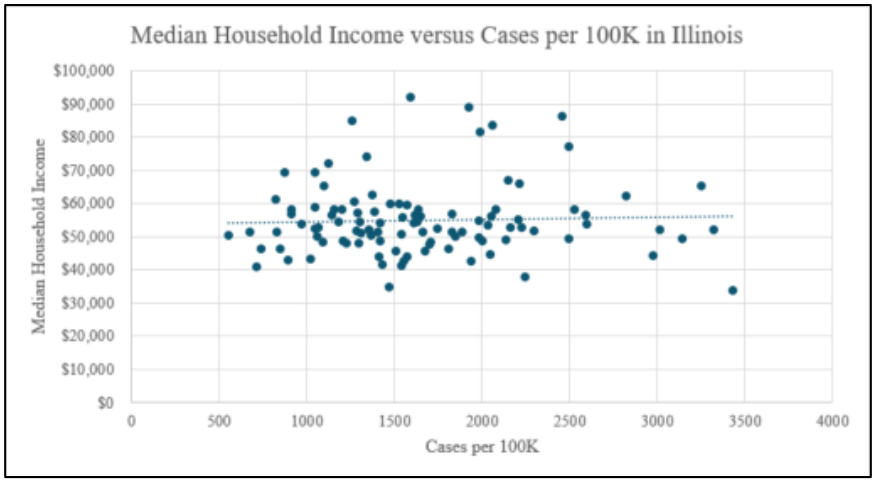

Figure 9. Percentage in Poverty versus Cases Per 100K in Illinois