

The Effect of COVID-19 on Various Demographics by Race in the United States

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Abstract—There is growing concern that racial and ethnic minority communities around the United States are experiencing a disproportionate burden of infection rate and mortality from the coronavirus disease 2019 (Covid-19). While most research, media newspapers, websites, and television networks are providing statistical numbers of daily infection and death rate across US by state, these numbers fail to study the actual impact of COVID-19 to each race. Our approach has taken the top five races by population count in the US and has calculated the impact index by race for each state for COVID-19 infections and death rate. We also examine the rise in the utilization of hospitals as a result of the rise in cases of COVID-19 in the United states. We conclude that the African American race and Hispanic race is disproportionately impacted more than the white population for infection rate.

Keywords— COVID-19, Race, Demographic Impact, COVID-19 Pandemic, Data Analytics

1 Introduction

Earlier this year, a pandemic originated in China, and spread across the world. Scientists all over the world are performing various researches to understand the impact of this pandemic. This includes its impact in different regions and races. This short paper intends to present statistical report of conclusions drawn from data extracted from John Hopkins University and Center for Disease Control and Prevention (CDC) [1]. The virus famously known as Coronavirus (COVID-19) belongs to the family of the seven viruses which include general flu and the deadly viruses like SERS and MERS which also caused epidemics in 2003 and 2012 respectively [2].

Research is increasingly showing racial and ethnic minorities being disproportionately impacted by COVID-19. From the data extracted from CDC and John Hopkins University, when the population in USA was categorized under four different races namely White, Black, Latino, Asian and American Indian and Alaska Native Resources (AIAN) and compared, the statistics showed a clear presentation of the impact on different races.

According to recent data from the CDC, non-Hispanic American Indian or Alaska Native people had an age-adjusted COVID-19 hospitalization rate of about 5.3 times that of non-Hispanic white people [3]. COVID-19 hospitalization rates among Hispanic or Latino people and Black people were both about 4.7 times the rate of white people. Impact data of COVID-19 that is distributed by race during the months of March to June 2020, can be used to draw further observations on the racial disparities in healthcare during the pandemic. Such disparities have various causes, both natural and circumstantial.

Among these causes are differences in healthcare access, preexisting conditions, occupation, income, and housing. Cases on discrimination and inadequate access to healthcare to ethnic minorities have been a long-standing issue. Conscious and unconscious racial bias by doctors may sacrifice the quality of care received by minority patients.

Furthermore, other factors like a lack of health insurance or not getting paid for “sick hours” could contribute to the lower quality of healthcare ethnic minorities may face. In 2017, according to the CDC, only about 6% of non-Hispanic white people were uninsured, while the rate was nearly 18% for Hispanics and 10% for non-Hispanic Black people [3].

There is no evidence of people with certain descent being more susceptible to the virus. However, certain preexisting conditions, such as type 2 diabetes, which does disproportionately affect minorities like the Pacific Islanders and American Indians, would put certain racial groups at a higher risk [4]. People from some racial and ethnic minority groups are disproportionately represented in essential work settings such as healthcare facilities, farms, factories, grocery stores, and public transportation. Many people of color have jobs that are considered essential and will involve interaction with the public or they have to be on-site, which means they can't work remotely.

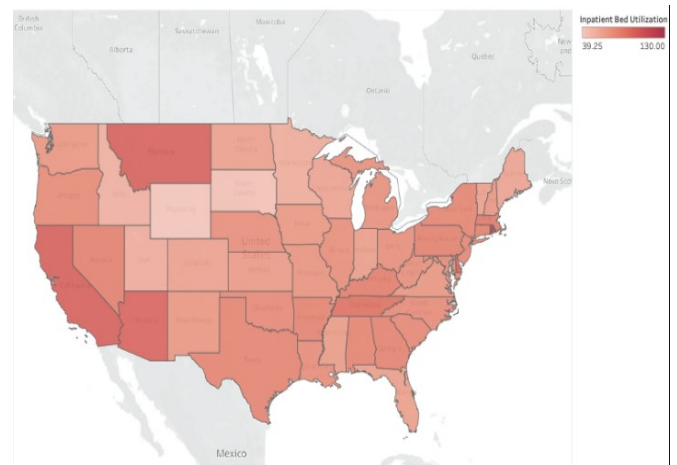


Fig. 1 Inpatient beds utilized (Data Source: Department of Health and Human Services, data used up to July 28, 2020)

With the huge rise in cases of COVID-19 in the United states, a rise in the utilization of hospitals can also be seen.

Recognizing the trends and relationships in hospital data is very valuable in better understanding the effects of the virus. The rise of cases means more patients occupying beds. During this virus outbreak we see a high occupancy of beds. Only two states are under a 50% utilization. These two states are Wyoming, 39.25, and South Dakota, 41.89. There are also 5 states that have a utilization over 90%. The states are Delaware, Arizona, California, Montana and Rhode Island. Rhode Island is also the highest with 118.09 utilization. Overall, there is a high utilization of inpatient beds with an average of 73.33. A visual representation of this data can be seen in Fig. 1 which is a heat map of mainland USA showing the intensity of utilization.

The rest of the paper is organized as follows: Section 2 discusses the related work in data visualization as well as immersive VR; Section 3 details the impact of COVID-19 on various races by the state in the US. Section 4 describes the observations and comparisons of the COVID-19 death rate. Section 5 describes the hospital utilization during COVID-19, and Section 6 discusses the drawn conclusions.

2 Related Work

In the U.S., according to the CDC nearly 25% of employed Hispanic and Black or African Americans work in the service industry that requires in person interaction, compared with 16% of white workers with similar type of job limitations. Also, African Americans also account for 30% of licensed practical and licensed vocational nurses [5]. Furthermore, people of color also depend more on public transportation to get to work compared to White. Other circumstantial factors, like housing, may also be the cause of ethnic minorities being affected by the virus at a disproportionately higher rate [6]. For example, racial and

ethnic minority members might be more likely to live in multi-family homes and densely populated areas. This can make social distancing difficult. These are just a few possible causes of the disparity that ethnic minorities face in having a higher infection and death rate of the COVID-19 virus [7]. This information is essential in recognizing the biases ethnic minorities face so that steps can be taken to close this gap in healthcare.

3 Impact Index Number

The following observations are based on data drawn from the CDC and Johns Hopkins database as of 23-Jul-2020 [8]. Discrepancies include the population of patients that chose not to report their race, which is reported in the raw data as well [9]. This graph in Fig. 2 shows the impact of COVID-19 on various races by the state in the US. It displays the infection and death rates by the proportion of each respective race's population, rather than the total population. The impact index is calculated by dividing the percent population of infected people by the percent of the total population that the race makes up, and the same is done with the death's statistics. Since the purpose of this study is to gauge the impact of the virus on the population by demographic, this impact index is a better representation of the data. If the infection and death tolls were to be divided by the total population, as it is in most visualizations, the resultant data would be skewed.

For example, races with a smaller population within a state would be underrepresented even with the same proportion of people affected as that of a race with a larger population. If each race were to be equally (proportionately) affected, the impact index value would be 1 throughout. Impact index values <1 , indicate that the race is less proportionately affected, and impact index values >1 , indicate that the race is

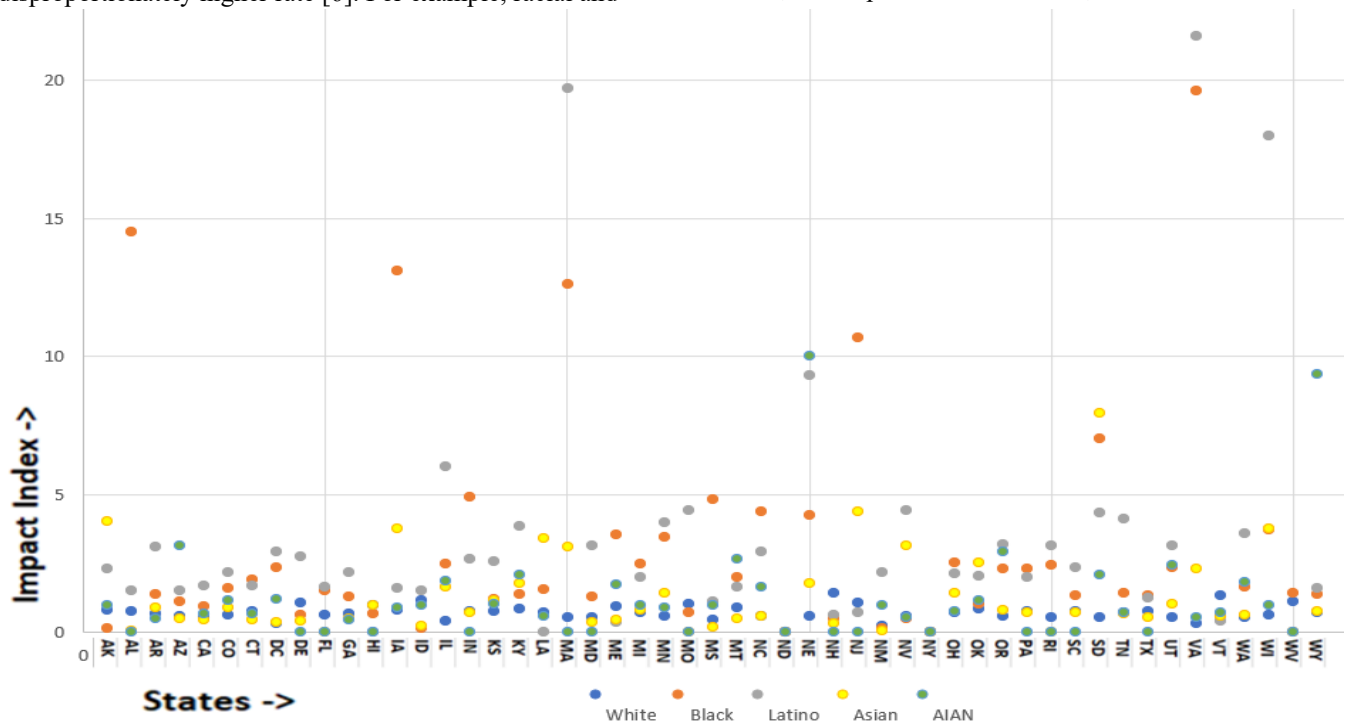


Fig. 2 COVID-19 Infection Rate Impact Index graph

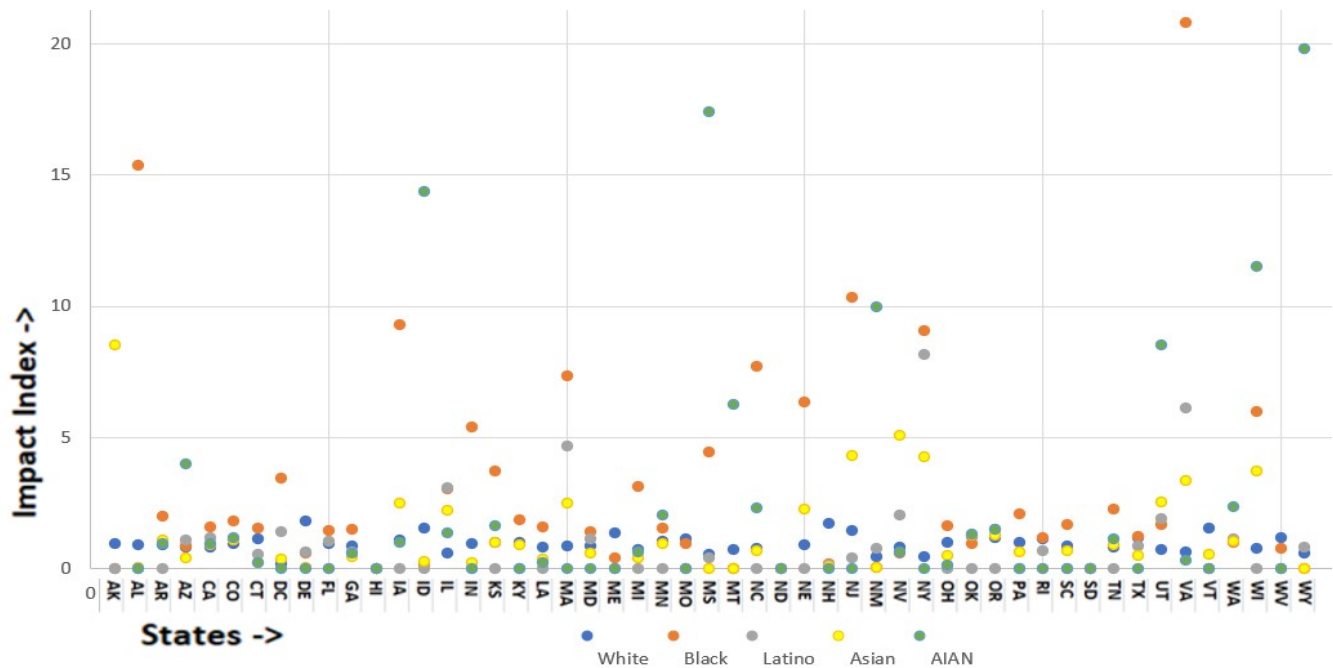


Fig. 3 COVID-19 Death Rate Impact Index graph

more proportionately affected. It would be beneficial to conduct statistical tests on the impact index data of different denominations to assess if there is evidence to support ethnic minorities being disproportionately affected by COVID-19.

4 Observations

The standard deviations of percent population of each of the five most common racial denominations are as follows- white: 0.16255, Black: 0.10606, Latino: 0.10322, Asian: 0.05452, American Indian/Alaskan Native: 0.02805. The standard deviations of the infection rate impact indexes of each of the five most common racial denominations are as follows- white: 0.274856255, Black: 4.041805052, Latino: 4.473870886, Asian: 1.51521626, American Indian/Alaskan Native: 1.925527419. Among the five most common racial denominations, the standard deviation of the Black and Latino population was higher. Therefore, the impact of COVID on these populations vary by a greater amount from state to state. Due to several major outliers.

The comparison of the COVID-19 death rate impact index shows that the blacks have the most death rate. In over 15 states they had twice the death rate (impact index > 2) compared the other race demographics. This is followed by American Indian and Alaska Native Resources, Latinos, and Asians. The Whites had the least death rate impact index. Table Raw Data Table of Covid-19 Death Rate Impact Index provided the data of the impact index by race and state.

The study of COVID-19 data in this research also found that the race demographic information is captured in higher percentage for death occurrence, compared to COVID-19 infections reported. Also, a few of the skewed numbers of impact index could be a result of population reported for each demographic by race from the census bureau.

In a T-Test conducted between the infection rate impact index of the white and Black population across all 50 states, the p-value is 6.494E-05. This indicates there is strong evidence against the null hypothesis, which is that no difference exists

in the infection rate impact index between the white and Black populations.

States	White	Black	Latino	Asian	AIAN
AK	0.93			8.55	21.20
AL	0.91	15.38		0.05	
AR	0.93	2.02		1.08	0.96
AZ	0.84	0.88	1.07	0.41	3.98
CA	0.84	1.58	1.20	0.92	0.97
CO	0.96	1.80	1.08	1.09	1.17
CT	1.12	1.53	0.55	0.25	0.23
DC	0.17	3.47	1.42	0.35	
DE	1.80	0.60	0.65	0.05	
FL	0.95	1.43	1.05		
GA	0.88	1.48	0.62	0.44	0.58
HI	0.00				
IA	1.10	9.30		2.51	0.99
ID	1.55	0.15		0.27	14.39
IL	0.58	3.06	3.09	2.22	1.38
IN	0.95	5.41		0.25	
KS	1.00	3.72		1.01	1.62
KY	0.99	1.86		0.91	
LA	0.82	1.60		0.36	0.23
MA	0.87	7.35	4.68	2.51	
MD	0.85	1.41	1.15	0.60	
ME	1.36	0.39		0.00	
MI	0.74	3.13		0.43	0.64
MN	1.04	1.54		0.94	2.05
MO	1.14	0.94			
MS	0.53	4.46	0.39		17.44
MT	0.73				6.28
NC	0.78	7.73		0.68	2.32
ND					
NE	0.91	6.34		2.29	20.12
NH	1.72	0.17	0.13	0.10	
NJ	1.47	10.35	0.42	4.32	
NM	0.45	0.07	0.77	0.03	10.00
NV	0.83	0.60	2.07	5.10	0.65
NY	0.44	9.07	8.18	4.25	
OH	1.00	1.65		0.51	0.16
OK	1.23	0.94		1.25	1.32
OR	1.20	1.49		1.25	1.49
PA	0.99	2.08		0.65	
RI	1.15	1.18	0.69		
SC	0.86	1.66		0.68	
SD					
TN	0.82	2.26		0.93	1.12
TX	1.17	1.22	0.87	0.48	
UT	0.73	1.69	1.89	2.54	8.54
VA	0.62	20.84	6.13	3.38	0.34
VT	1.56			0.57	
WA	1.03	1.01	1.13	1.06	2.37
WI	0.79	6.00		3.74	11.52
WV	1.17	0.78			
WY	0.60	0.00	0.83		19.84

Fig. 4 Table of Covid-19 Death Rate Impact Index (1-1.49 is Yellow; 1.5-2.0 Orange; Greater than 2.0 is Red)

It suggests there is a statistically significant difference between the two demographics. In a T-Test conducted between the infection rate impact index of the white and Latino population across all 50 states, the p-value is 5.30886E-05. Again, the p-value suggests that the null

hypothesis can be rejected and that there is a statistically significant difference between the two groups. These findings support that the Black and Latino minority populations have been disproportionately affected by COVID-19 in infection rates.

In a T-Test conducted between the infection rate impact index of the white and Black population across all 50 states, the p-value is 6.494E-05. An Impact Index calculated across the overall population in the USA showed the following results based on the data collected until 23-Jul-2020. This data is based on the census bureau population percentage by race reported in July-2019. The above impact index across the USA shows that the African American (alone) population is impacted most with a death rate impact index of 1.78 and infection rate impact index of 1.59. The second highest impact is for the Latino (alone) population with a death rate impact index of 0.88 and infection rate impact index of 1.74. The third highest impact is for the American Indian and Alaska Native (alone) population with a death rate impact index of 0.65 and infection rate impact index of 1.0. Fourth highest is the White (alone) population with a death rate impact index of 0.91 and infection rate impact index of 0.70. The least impacted are the Asian population with a death rate impact index of 0.73 and infection rate impact index of 0.52.

Top 5 Racial Demographic by Population (Alone)	% Total Population in USA	Total Cases	Total Deaths	Cases Impact Index	Deaths Impact Index	Deaths to Infected Ratio
White	60.10%	985,321.00	67,174.00	0.70	0.91	1.29
African American	13.40%	498,645.00	29,380.00	1.59	1.78	1.12
Latino	18.50%	751,194.00	20,142.00	1.74	0.88	0.51
Asian	5.90%	71,519.00	5,314.00	0.52	0.73	1.41
AIAN	1.30%	30,336.00	1,036.00	1.00	0.65	0.65
Total		2,337,015.00	123,046.00			

Fig. 4 Table showing summary of Covid-19 Cases and Death rate Impact Index across the USA as of 23-Jul-2020

Furthermore, the ratio of death rate to infection rate is highest for the Asian population (1.41), followed by White population (1.29), and African American population (1.12). This ratio indicates there is a higher proportion of White and Asian population in their older age who are infested and hence the ratio of death rate to infection rate is higher in these demographics. The Latino population has the least ratio of death rate to infection rate at 0.51. This shows majority of the Latino population are younger people and the death rate is lower among the younger people.

The data for this research was extracted from CDC and Johns Hopkins daily COVID-19 cases and deaths update database for the US [9]. One of constraints of this data was that the number of people who reported their race during COVID-19 testing accounted for 55.7% of the total number of people who tested positive. As of July 23, 2020, the total number of cases reported was 4,206,242, and out of these cases, 2,346,209 people reported their race.

A similar constraint existed in the data for reported deaths of which 86.6% of people have reported their race. As of July 23, 2020, of the 142,155 reported deaths, 123,046 people reported their race. The scope of this paper excludes the population that has not reported their race.

5 Hospital Utilization

Nationwide hospital inpatient rates can be observed to deduce the relative severity of cases among states. Fig. 6 shows that, on average, there was high percentage of inpatients in southern parts of the country. More specifically, was a higher concentration of critical cases in the western and middle sections of the South. Arizona, at 41.95%, had the highest percentage of inpatients with COVID-19, compared to Maine which had the lowest percentage of 1.42%.

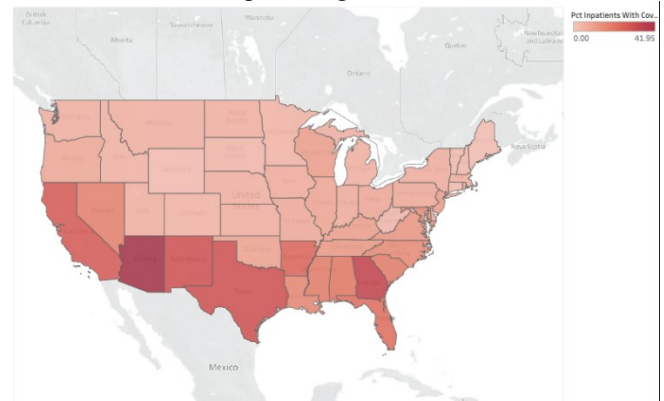


Fig. 6 Percentage of inpatients with COVID-19 (Data Source: Department of Health and Human Services, data included up to July 28, 2020)

Another aspect that was studied was the amount of deaths caused by COVID-19 [10,11]. New York, at a recorded 32,645 deaths, had an extremely high number of deaths compared to the other states, most likely due to its population density. New Jersey follows with 15,804 deaths, which is only around half of the amount of deaths in New York. The next three highest death rates come from California, Massachusetts and Illinois. It can also be seen that the four of the six states with the highest death rates are neighboring states. A visual representation of this can be seen in Fig. 7 and Fig. 8.

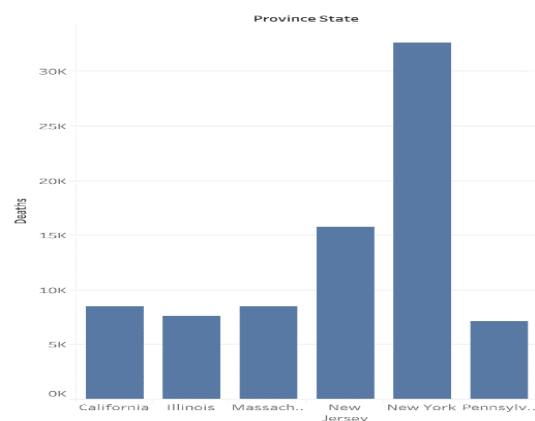


Fig. 7 Percentage Total COVID-19 deaths by state (Data Source: Center for Systems Science and Engineering at Johns Hopkins University, data included up to July 28, 2020)

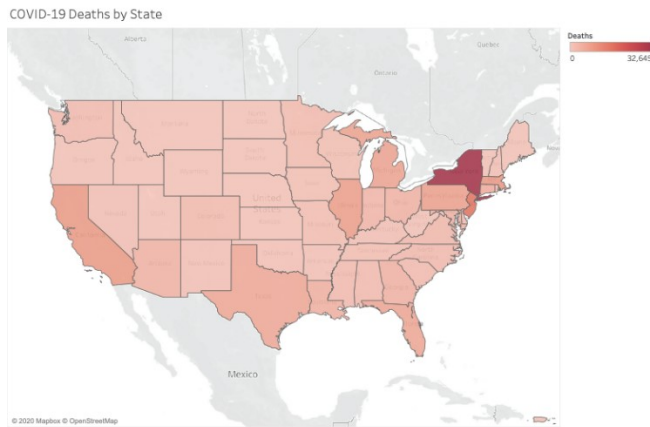


Fig. 8 COVID-19 deaths by state (Data Source: Center for Systems Science and Engineering at Johns Hopkins University, data included up to July 28, 2020)

Only a few states, South Dakota, Maine and Vermont, showed a recovery rate of higher than 80%. Fig.8 shows the breakdown of recovery rate by state. Although, recovered cases were not available for states such Florida and California.

6 Conclusion

To summarize, the COVID-19 impact on various demographics is different for different race. The African American race is impacted the most when comparing the infection rate impact index, death rate impact index, and the death to infection impact index ratio. The Latino population are the second most impacted with the highest impact index for infections, however their death rate to infected rate ratio is the lowest. The White population who represent 60% of the overall US population are impacted at 41.5% for COVID-19 infection rate when compared to the African American and Latino combined population impact for infection rate. The White and Asian population who have the least impact on the infection rate, but the highest for death rate to infection rate ratio when compared to African American and Latino combined population impact.

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