Impact of the COVID-19 Pandemic on BIPOC populations

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1. Introduction

The current outbreak of the novel coronavirus SARS-CoV-2 of 2019, COVID-19, traces its origins back to Wuhan, China before quickly spreading worldwide. In March 2020, the World Health Organization (WHO) declared COVID-19 a pandemic and was declared as a global health emergency. [1] At first, it was unknown about the causes and effects of this disease, specifically how it was contracted and who would be at risk. However, as time progressed, and people continued to get sick, public health organizations like the United States' (US) Center for Disease Control (CDC) coordinated with the WHO and continued to monitor the pandemic and provide more updated information as it became available.

The COVID-19 crisis and subsequent aftermath have disproportionately affected certain marginalized groups across racial and ethnic boundaries. The pandemic illuminated long-standing systemic health and social inequalities combined with widespread fundamental structural problems that further exacerbate racism against Black, Indigenous and People of Color (BIPOC). John S. Rolland (2020) found that, "July 2020 CDC data reveal that Latinx and African-Americans are three times as likely to become infected with COVID-19 as their white neighbors throughout urban and rural regions of the United States and across all age groups. And they are twice as likely to die from the disease as white people. (p. 926). [2] A study by Maroko, Nash, and Pavilonis (2020) of hot spot neighborhoods in Chicago and New York City found that in New York City the hot spots were working-class and middle-income communities. Whereas, in Chicago it was their most vulnerable citizens that were living in low-income neighborhoods, experienced "extremely high rates of poverty, unemployment, and NH Black residents." (p. 468). [3]

This report will investigate the disproportional representation among the people of color compared to the white population on a national, regional, and state-level in United States by analyzing reported data on COVID-19 associated cases, hospitalizations, and subsequent deaths. Visualizations created by the team will showcase these findings and showcase the stark contrast between the effects the pandemic has had on non-white populations versus white populations.

2. Materials/ Software Used

Python, Google Data Studio, and Tableau were utilized in conjunction for data cleansing, mining, and creating visualizations to perform an analysis of the reported data to garner real meaningful conclusions. Python software was combined with libraries such as Pandas and NumPy for increased functionality. It was using this we were able to perform data cleaning and manipulation functions. Python was used with the Altair Visualization library was to create streamgraph visualizations. Google Data Studio, which is free web-based visualization software. It creates dashboards that can be used by individuals, small businesses, and enterprises. Finally, Tableau, functions the same as Google Data Studio. It is also free to use, but unlike Google Data Studio, it is a downloadable software. Google Data Studio and Tableau public software were used to depict the trends, patterns, and variations with line graphs, bar charts, and bullet graphs. Overall, it was the use of all these applications with their own uses to help create these ideas.

2.1 Dataset Info

We utilized the csv dataset from "The COVID Racial data Tracker at The Atlantic" [11]. Reported Data represents COVID-19–associated cases/deaths/hospitalizations by race and ethnicity (categorized as Hispanic, White, Black, non-Hispanic Asian [Asian], non-Hispanic American Indian or Alaska Native [AI/AN], non-Hispanic Native Hawaiian or other Pacific Islander [NHPI], non-Hispanic multiracial [multiracial], and unknown). The group focused only on cases and deaths by races for this study.

While this dataset provided a lot of useful information, it was needed to make a few calculations and adjustments in order to perform the full analysis. New York (NY) and the US territories were removed from the dataset because NY did not report cases by race and ethnicity, and the US territories were outside the scope of this paper. Also incorporated into the research was the dataset provided by *US States by Race 2020,* (https://worldpopulationreview.com/states/states-by-race) in order to determine the population percentages of each race in each state and the group included a region column to categorize the states into different US regions. [4]

For part of the analysis, the group combined all races except for unknown and white into one group as *non-white*, in order to show us an overall grouping of people of color. The group found the *non-white* population percentage in each state by taking the white population percentage presented in the World Population Review dataset and subtracting it from 1.

The group did the following calculations to illustrate the potential differences in the burden of cases/deaths due to COVID-19 according to race. See the Appendix section for information on datasets:

- **Count of COVID-19 Case and Death Totals:** Sum of number of cases/deaths due to COVID-19 reported for each race (excluding unknown) respectively. [Cases_Total-Unknown, Deaths_Total-Unknown]*
- **Distribution of COVID-19 cases/deaths (%):** Cases/Deaths for white and non-white group as a percent of the total number of COVID-19 deaths reported[PercentCases_Non-White, PercentCases_White, PercentDeaths_NonWhite, PercentDeaths_White]*
- **Unweighted distribution of population (%):** Population of white and non-white group as a percent of the total population.These unweighted distributions can be used to obtain a crude (unadjusted) estimate of the percent of COVID-19 cases/deaths experienced by some groups relative to their observed percent of the population. [5]. [PercentPoP NonWhite, PercentPop White]*.
- **Death and Case ratio:** Percent of reported cases/deaths of the white and Non-White divided by percent of population represented by each group on each of US states, respectively. [CasesNon-White/Non-White Pop, CasesWhite/White Pop, Deaths_NonWhite/NonWhite POP, Deaths_White/White POP].

[] *- Column names in the dataset*

3. Data mining and preprocessing

In order to gain some meaningful insights from the visualization, the group used few feature preprocessing techniques on the data using python code which are as follows: *standardization* for including the percentages, *outlier removal* for removing the states that did not provide the racial distribution with respect to Cases/Deaths, *normalization* for calculating the rate ratios.
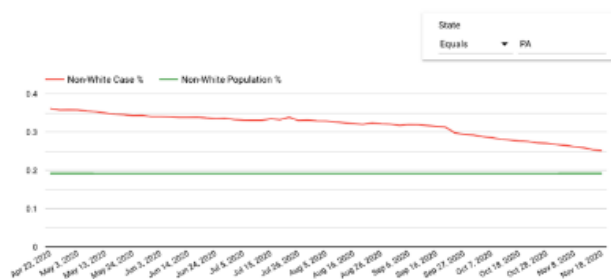
How to read case/death ratios:

Figure 1

The ratio represents how many times higher or lower the group's percentage of cases or deaths is than their overall population. For example, if the non-white group had a case ratio of exactly 1, this would show that non-white people were contracting COVID-19 at an equal rate to their population percentage. This would be ideal and would show that they are not disproportionately affected. If the non-white group had a ratio greater than 1, i.e., 1.5, this would show that the non-white group is contracting COVID-19 1.5x greater than expected if there was equality. For reference, Figure 1 shows the percent of non-white cases in PA (red) vs. the percent of population they account for in PA. The closer the two lines are, the closer to equality in case rates.

4. Analysis and Findings

Research study shows Persons aged ≥ 65 years and members of minority racial and ethnic groups are disproportionately represented among COVID-19–associated deaths. [6]. Understanding the demographic and clinical characteristics of decedents could inform medical and public health interventions focused on preventing COVID-19-associated mortality. [7]. We built the following visualizations to validate how the non-whites are disproportionately represented with respect to US at a national level, region level and finally at state level.

4.1 Visualization Interpretation at the National Level

4.1.1. Cases timeline

To illustrate the progression of the pandemic at the macro-level (i.e., across all 50 states), a streamgraph is used in figure 2. The count of new cases (reported bi-weekly) for each of the reported races shows the relative spread of the virus over the past 7 months with areas of surges and declines being observed. In particular, the exponential increase of new cases in late October and into November is unlike that of any case surge prior, with the number of new

cases more than doubling the surge in late August. These surges and decline events appear to be shared among the different races, with the white population having a majority of cases, but without relative population size the individual impact by race cannot be derived.
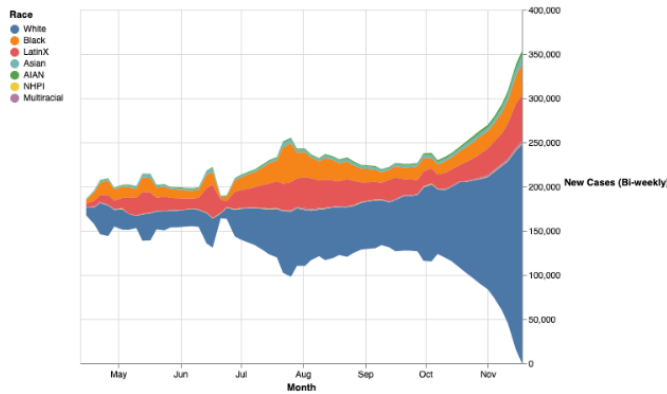

Figure 2: New bi-weekly case counts for each of the reported races

Although the United States is one of the most racially diverse countries in the world, it is predominantly white at ~60% of the population, which is more than 3x greater than the next largest race. Therefore, it is important that race data analysis includes the relative population between races rather than the raw, unweighted data. In the context of this COVID-19 dataset, the total number of cases and deaths can be misleading if not given the proper balance. In figure 3 the importance of this population-share analysis is illustrated by comparing the total number of cases in the U.S. for all reported races. On the left the total, unweighted case numbers are given, suggesting that the white population is heavily impacted by COVID-19 as it has the greatest number of cases; however, when the data is weighted by the total population of each race (right-hand graph), it is evident that only a fraction of the total white population has been impacted.
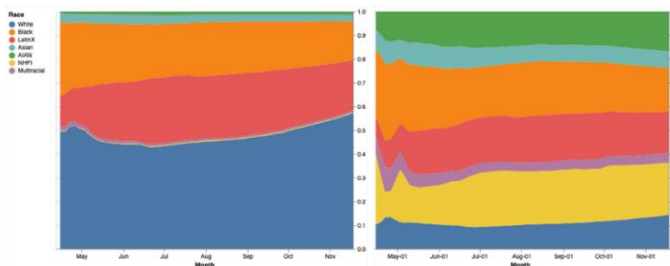

Figure 3: Normalized total case counts unweighted (left) and weighted by race population size (right)

While total case and death counts of the non-white population is disproportional to that of whites, it is also

worth investigating the healthcare provisions received. A possible indirect indicator of this would be the total, unweighted death-to-case ratio for each race. In figure 4 the monthly aggregated ratio of deaths-to-cases is shown for the 3 largest race populations (White, Latinx and Black). This visualization shows that the total, combined ratio has decreased significantly since the beginning of the pandemic, indicating that healthcare providers have learned how to better treat this novel virus. It also suggested that there is not a significant gap in healthcare provisions between the races between July and November.
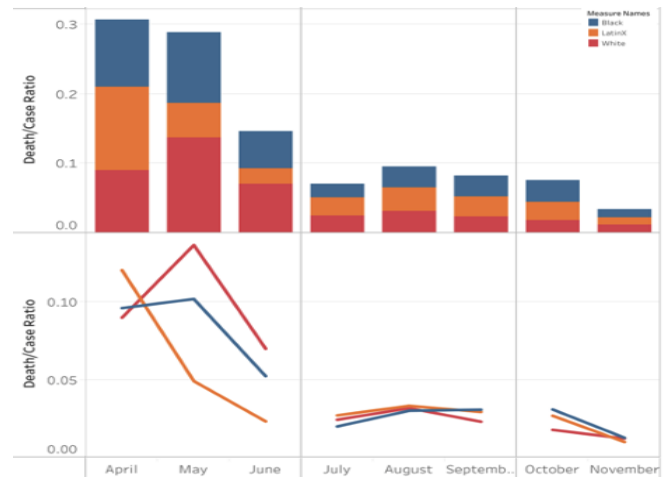

Figure 4: Death-to-case ratio of the 3 most populous race

4.2 Visualization Interpretation at the Region Level

Figure 5 below represents the case and death ratios calculated for white and non-whites with respect to each US Region. Data labels are displayed only for the ratios of non-whites on Figure 5 for quick reference. It is clear from Figure 5 that Death and Case non-white ratios are generally higher compared to white ratio in all the regions. When investigated non-white case ratios, they tend to be higher in *West, Midwest and Northeast compared to others*. The death ratios as well are higher for *West* and *Midwest*. But interestingly, although the Case ratio is higher, the death ratio for *Northeast* is slightly lower compared to the other regions and death ratio for *South* is relatively higher despite their lower-case ratio.
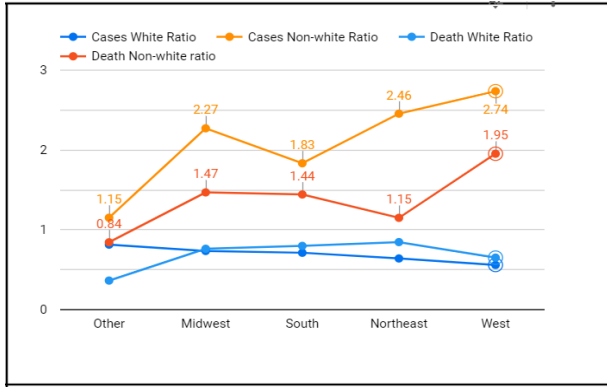
Figure 5: Case and Death White/Non-white ratio for US region

Figure 6 digs deeper into the non-white death ratio by providing the monthly trends for different US regions. The Death ratio for the *West* region is relatively higher in the months of July, August, September and October respectively compared to the other months which has contributed to the highest death ratio compared to the other months. *Midwest* and *Northeast* region seem to have a consistent pattern in their death ratios across all the months reported. *South* Region had a low death ration at the beginning and then seem to have a consistent pattern. *Other* Region interestingly had very less death ratio for several months in the beginning but going up in the most recent months.
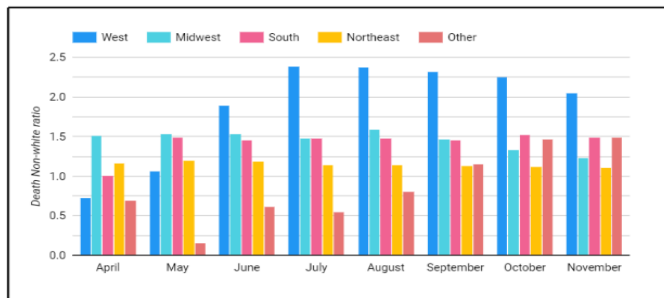

Figure 6: Monthly Death Non-white ratio by US region

Some states report deaths daily, while other states report deaths weekly or monthly. State vital record reporting may also be affected or delayed by COVID-19 related response activities.[8]. The group wanted to provide a quick overview of the key states in a tabular view that contributed to the upsurge in non-white death ratio by each region/state from the visualization displayed on Appendix (Figure 7).

Region	Key States	Non-white Death Ratio
West	Wyoming (WY), Utah (UT), Montana (MT), Arizona (AZ), New Mexico (NM), Colorado (CO), Michigan (MI)	>2.0
Midwest	Missouri (MO), Wisconsin (WI), Illinois (IL), Kansas (KS), Indiana (IN)	>1.5
South	Texas (TX), Florida (FL), Arkansas (AR), Tennessee (TN)	>1.5
Northeast	District of Columbia (DC), New Jersey (NJ) and Pennsylvania (PA)	>1.4
Other	Alaska (AK)	>1.0

Table 1 Presents the key states in each region of the US with the highest Non-White Death Ratio

4.3 Visualization Interpretation at the State Level

An even more granular approach can be taken to this analysis by looking at each individual state's performance. For this the primary focus was on the case and death ratios for both the white and non-white groups. Presented in this section are a few states of interest that were able to give a good understanding of how a different variety of states are performing. We selected Maine: the state with the lowest percentage of non-white population and one of the lowest populations, Maryland: the state with the highest percentage of non-white population (outside of Hawaii), Pennsylvania: the authors' home state, Texas: the state with the second largest population in the US [4] .While we limit the scope of this paper to viewing these few states, further information and graphs can be found by following this link: https://datastudio.google.com/s/me6VHn43-9c and filtering for each state by 2-digit state code.

We will first compare the case ratio for the white and non-white groups. Figures 8-11 display the case ratio comparison for all 5 states of interest, with the blue line showing the white group case ratio, and the red line showing the non-white case ratio. The green line represents an ideal line (drawn at 1) where both lines would be equal to if both groups were contracting COVID at expected rates. The most glaring thing we see from these graphs is that in each state non-white people have a higher case ratio. This shows us that the percentage of cases for non-white people in each of these states is higher than their percentage of population. Further proving out point that non-white people are contracting the disease at higher rates than white people. This is occurring regardless of other factors.

Maine, the state with the lowest population percentage of non-white people has extremely high number of non-white cases per population getting up to ~6x the population percentage of non-white people (Figure 8). We can compare this to Maryland (Figure 9) which has the highest population of non-white people (excluding Hawaii). Although the ratio is lower, it is still consistently over 1.5x the non-white population percentage. Texas

(Figure 11) seems to have a problem as well, with well over 2.5 non-white case ratio throughout a majority of the time. Considering that Texas has the second largest population in the US, we can see that this is could be a major contribution to the disproportionate cases in the US as a whole. PA (Figure 10) meanwhile is the closest to even. One major aspect that we do see is that states for the

Figure 8 - Maine Case Ratio White vs Non-White
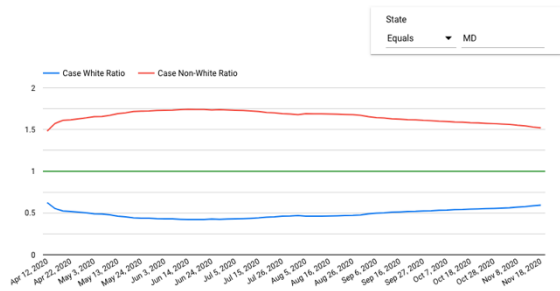

Figure 9 – Maryland Case Ratio White vs Non-White
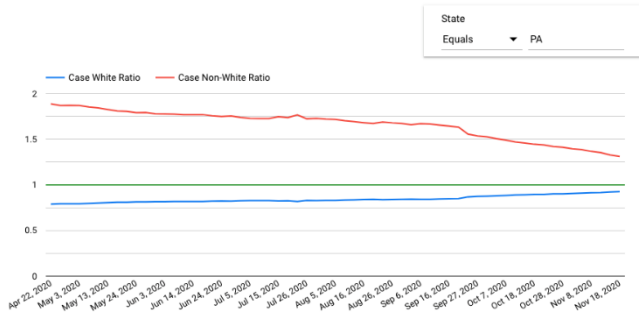
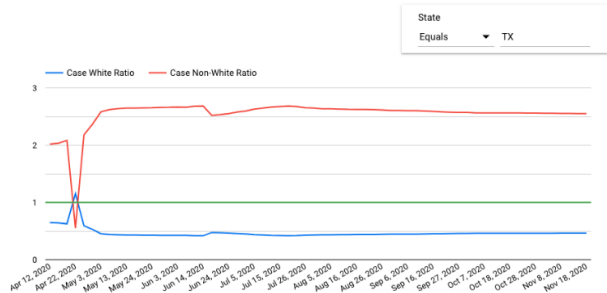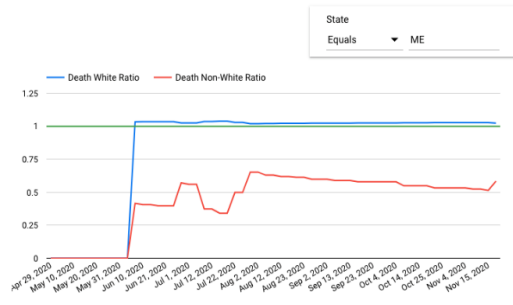*Figure 10- Pennsylvania Case Ratio White vs Non-White*

Figure 11 - Texas Case Ratio White vs Non-White

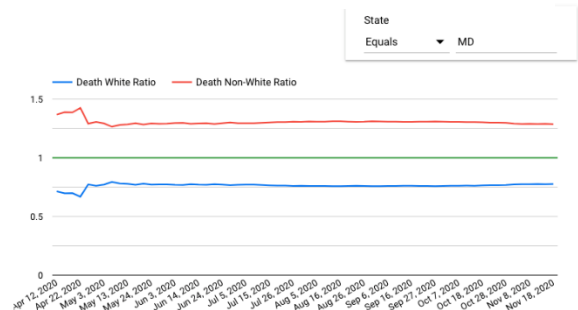*Figure 12 - Maine Death Ratio White vs Non-White*

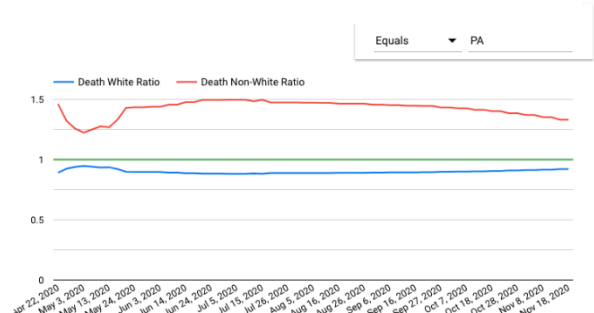*Figure 13 - Maryland Death Ratio White vs Non-White*

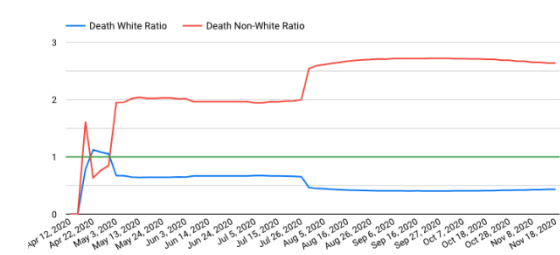*Figure 14 - Pennsylvania Death Ratio White vs Non-White*

Figure 15 - Texas Death Ratio White vs Non-White

most part seem to be leveling out and over time we even see some dips indicating that future may result in a more even rate of cases. At least, it appears that things are not getting worse as they did within the first month or two.
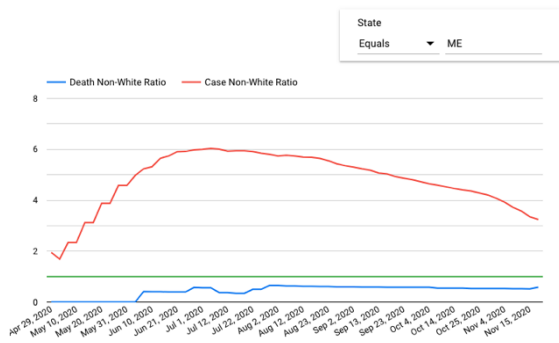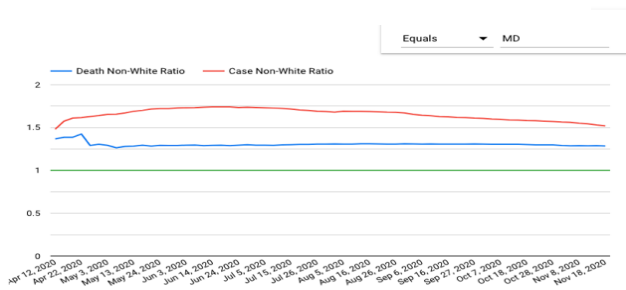

Figure 16 - Maine Death vs Case Ratio Non-White

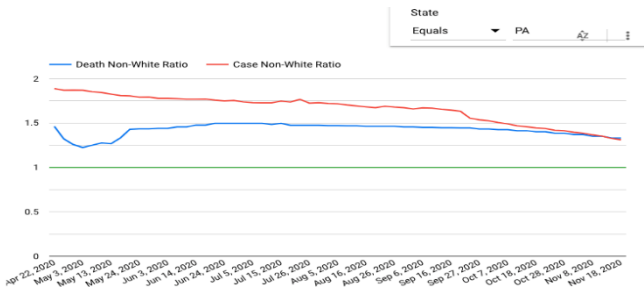*Figure 17 - Maryland Death vs Case Ratio Non-White*

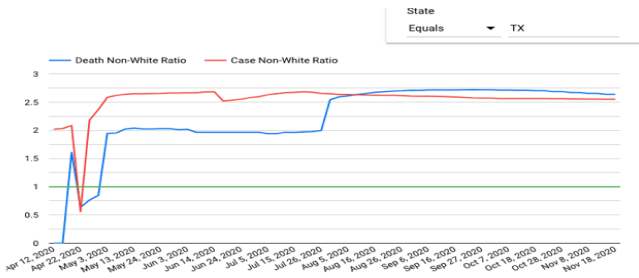*Figure 18 - Pennsylvania Death vs Case Ratio Non-White*

Figure 19 - Texas Death vs Case Ratio Non-White

Next, we looked at the death ratios to see how our states of interest compare. To do this we will look at Figures 12-15.

Besides Maine, we again see consistently higher death ratios for non-white people than white people. Out of these

states, Maine (Figure 12) has a lower death ratio for non-white people. The one thing to note however is that Maine has one of the lowest populations in the US, so this is not likely to have a major effect on the US as a whole. Texas (Figure 15) in comparison has a much higher non-white death ratio, which could have a significant impact to the US. While there have been some increases in each state, much like the charts for cases it appears that at the very least non-white people are not increasingly disproportionately dying from COVID-19, and if anything, it is becoming slightly more equal.

Finally, we can compare non-white case and death ratios to determine how states are performing in cases and deaths and how these two numbers compare to each other.

Figures 16-19 can give us considerable insight into how well states are treating non-white Americans who have COVID-19. First take Maine (Figure 16) for example. The state's case rate is through the roof, yet the death rate is below expected. So even though non-white people are contracting COVID-19 at a higher rate per population, they are dying at a lower rate. We can also look at Maryland (Figure 17). While both ratios are above what is considered equal or fair, the death rate is at the very least below that of the case rate. Texas (Figure 19) on the other hand has had a death ratio above the case ratio since August. Not only are they very poor when it comes to disproportionate cases, but their death proportion is even worse. In PA (Figure 18) we are seeing slight downward trends for both ratios, however it appears the state is doing a better job at reducing case disproportions than death disproportions.

Overall, each of these graphs show that non-white people are overwhelmingly disproportionately affected compared to white people. The population percentage the US and individual states do not affect this fact. While there are a few outliers, these do negate the fact that it has consistently occurred for most of the pandemic thus far in the United States. This proves just how big of an impact it has to the non-white community. It is apparent that non-white people are being affected at higher rates. Compounding rates of which are resulting to a very high total disproportion. The one thing that is promising is that these percentages are not increasing and in some states are decreasing – showing that it appears states are beginning to have this under control and may be taking action to reduce the unfair impacts to non-white people.

5. Conclusion and Discussion

Many factors contribute to the non-white disproportionality in the reported cases/deaths on COVID-19 pandemic. It is believed that these factors may be influencing the risk of infection and/or the risk of death among those infected. Critically, however, these data do not take age or unknown race or ethnic groups into account. There are concerns about data quality regarding COVID-19 in general, including the attribution of deaths to the virus, testing rates, access to healthcare and so on; but problems with the data are unlikely to account for these stark differences by race shown here. [9]

In the article, *The African American petri dish* three facts are outlined by Ronald Braithwaite, PhD and Rueben Warren, DDS, DrPH, MDiv (2020) which explain why there the African American and other minority communities are being hit so hard with the coronavirus. First, COVID-19 ravages those with pre-existing health conditions. Since the mid-20th century, it was recognized by the U.S. federal government that African Americans were disproportionally affected by a wide range of fatal illnesses. These include, but are not limited to: Type 2 Diabetes, end-stage renal disease, cardiovascular disease, and asthma. Second, because the African American community is already at risk for fatal illnesses, the chances of suffering and death from it puts them at a greater risk than white communities. Lastly, a preventative measure for slowing and preventing the spread of COVID-19 is by social distancing. However, working-class essential positions have been working since the start of the pandemic. Many of these jobs: home health aides, corrections officers, security, janitorial and housekeeping and other low-paying health care positions are at risk. "As the Bureau of Labor Statistics makes clear, members of most minority groups are over-represented in such jobs." (p. 492). [10]. The pandemic has presented a full display of classist policy. Those in low-wage positions who are deemed essential workers, have been putting them and their families at risk. They have less opportunities for self-isolating and social distancing. Also, it was discovered in a study down by California-based retrospective cohort analysis that it is possible that compared to other races, African Americans were receiving tests later. (Maroko, 2020). [3] These factors create a dangerous cycle of terror for minority communities. If people living in a low-income neighborhood/ in a poverty are disproportionally people of color and are forced to work, they are at risk.

With the pandemic being ongoing as of the writing of this report, there is a lot of data that is yet to be uncovered to show the true effects that COVID-19 will have. However, there is factual evidence that presents a dark reality facing the BIPOC population. The pandemic has reiterated an existing problem where minorities are disproportionally ravaged from health crisis due to systematic issues in the economy, health care, and overarching society. With the information provided in this report by visualizations and extensive research, it is clear that work must be done to stop these systemic inequities.

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[7] Wortham, L. (2020). Characteristics of Persons Who Died with COVID-19 — United States, February 12–May 18, 2020. Morbidity and Mortality Weekly Report, 69(28), 923–929. https://doi.org/10.15585/mmwr.mm6928e1

[8] Center for Disease Control and Prevention. (2020). COVID-19 Provisional Counts - Health Disparities. Centers for Disease Control and Prevention. Retrieved from, www.cdc.gov/nchs/nvss/vsrr/covid19/health_disparities.htm.

[9] Ford, R. (2020). Race gaps in COVID-19 deaths are even bigger than they appear. In Up Front [BLOG]. The Brookings Institution.

[10] Braithwaite, W. (2020). The African American Petri Dish. Journal of Health Care for the Poor and Underserved, 31(2), 491–502. https://doi.org/10.1353/hpu.2020.0037

[11] "The COVID Racial Data Tracker." The COVID Tracking Project, https://covidtracking.com/race

Appendix:

1. **Dataset used for the report**
   a. **Covid_Data_Races_Distribution** https://drexel0-my.sharepoint.com/:x:/g/personal/rmt63_drexel_edu/EU9ttzBmr6xAk1juCInOZYwBKLqqYy4qSxMazOA-2j0GYA?e=9wjqfv

2. **Figure 7 – Death non-white ration by US State/region**

Deaths Non-white ratio by US State/Region

Region	State	Death Non-white ratio
Midwest	IA	1.0
	IL	1.9
	IN	1.7
	KS	1.8
	MN	1.0
	MO	2.2
	OH	1.1
	SD	1.1
	WI	1.9
Northeast	CT	1.1
	DC	1.5
	DE	1.1
	MA	1.2
	MD	1.3
	ME	0.4
	NH	1.1
	NJ	1.4
	PA	1.4
	RI	1.0
	VT	1.0
Other	AK	1.3
	HI	0.4
South	AL	1.4
	AR	1.6
	FL	1.8
	GA	1.3
	KY	1.4
	LA	1.3
	MS	1.4
	NC	1.3
	OK	0.8
	SC	1.4
	TN	1.6
	TX	2.2
	VA	1.2
	WV	1.4
West	AZ	2.2
	CA	1.7
	CO	2.1
	ID	0.5
	MI	2.1
	MT	2.4
	NE	1.0
	NM	2.2
	NV	1.4
	OR	1.3
	UT	2.9
	WA	1.3
	WY	4.1