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ARTICLE

Social Implications of COVID-19 Deaths: Analyzing Race, Ethnicity, Socio-Economic Conditions, Gender, and Age for the US

Saagar S Kulkarni[1*], Kathryn E Lorenz[2,3]

[1] Boonshoft School of Medicine, Wright State University, USA
[2] Clinical Faculty, Boonshoft School of Medicine, Wright State University, USA
[3] Family Practice Physician, Premier Physician Network, Troy, Ohio, USA

[*] Corresponding author email: ss1kulkarni@yahoo.com

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ABSTRACT

This paper examines two CDC data sets in order to provide a comprehensive overview and social implications of COVID-19 related deaths within the United States over the first eight months of 2020. By analyzing the first data set during this eight-month period with the variables of age, race, and individual states in the United States, we found correlations between COVID-19 deaths and these three variables. Overall, our multivariable regression model was found to be statistically significant. When analyzing the second CDC data set, we used the same variables with one exception; gender was used in place of race. From this analysis, it was found that trends in age and individual states were significant. However, since gender was not found to be significant in predicting deaths, we concluded that, gender does not play a significant role in the prognosis of COVID-19 induced deaths. However, the age of an individual and his/her state of residence potentially play a significant role in determining life or death. Socio-economic analysis of the US population confirms Qualitative socio-economic Logic based Cascade Hypotheses (QLCH) of education, occupation, and income affecting race/ethnicity differently. For a given race/ethnicity, education drives occupation then income, where a person lives, and in turn his/her access to healthcare coverage. Considering socio-economic data based QLCH framework, we conclude that different races are poised for differing effects of COVID-19 and that Asians and Whites are in a stronger position to combat COVID-19 than Hispanics and Blacks.

Keywords: COVID19, US Demographic Analysis, Socio-economic Analysis

1 Introduction

In 2017 the CDC reported more than 2.8 million total deaths due to various causes [1]. Diseases of the heart were the number one cause of death with a count of more than 647,000. Influenza and pneumonia caused more than 55,000 deaths and were ranked 8th in causes of death. By August 20, 2020, the US has seen more than 175,000 deaths due to COVID-19. Charbel el Bcheraoui et al. documented a declining trend of infectious disease mortality in the US due to better health care and vaccines from 1980 to 2014. They however did conclude that infectious diseases do pose a major health threat due to an increase in contact between humans and previously unknown pathogens [2].

Ethnicity combines the effects of a person's genetic make-up, social constructs, including cultural identity, and also behavioral patterns [3]. Ethnicity could likely contribute to the spread of the virus in a community; for example, cultural, behavioral, work and living differences due to lower socioeconomic status, health-seeking behavior, and intergenerational cohabitation seen in certain communities could all contribute. So far, none of the top ten countries with COVID-19 cases have reported ethnicity-related data. In the UK, mortality reporting does not require documentation of ethnicity-related information. Understanding the relative importance of ethnicity-related factors will require both qualitative (behavioral response to pandemic) and quantitative (absolute risks and outcomes) prospective studies [4].

Rentsch *et al.* [5] study analyzed about 6 million US veterans to understand racial and ethnic disparities in COVID-19 testing and subsequent mortality. The study found that both African Americans and Hispanics were more likely to be tested for COVID-19 and both groups tested positive for the infection at a higher rate than Caucasians. These findings were true irrespective of an individual's underlying health conditions, age, gender demographics, and geographical location. However, this study did not find a difference in 30 day mortality when comparing between race or ethnicity [5].

Multiple studies of large US metropolitan areas (e.g. Chicago, Illinois and Milwaukee County, Wisconsin), with higher concentrations of racial and ethnic minorities and adverse social determinants that may not adequately permit safe social distancing, have been conducted. These studies have shown a higher rate of COVID-19 infections in these areas. Gaining a better understanding of COVID-19 infections related to various demographic factors is necessary to come up with better healthcare services for minority populations [6,7].

This paper specifically looks at demographic factors such as age, race, gender, and state of residence to find out which demographic factors contribute most to COVID-19 deaths in the United States. This comprehensive analysis is conducted over the first eight months of 2020 using two different CDC-based data sets. Furthermore, a novel Qualitative socio-economic Logic based Cascade Hypotheses (QLCH) of education, occupation, and income affecting race/ethnicity are evaluated using US government's latest socio-economic data reports. A better understanding of how these demographic factors in concert with socio-economic factors contribute to COVID-19 deaths will guide us in developing better public policies to combat the pandemic.

2 Data acquisition and analysis

2.1 Database selection

We used data collected by the CDC for both analyses, limiting our dataset to COVID-19 deaths for the first eight months of 2020 [8,9]. The first data set looked at several demographic factors including 11 age groups, race, and states of residence in respect to COVID-19 deaths for a total of 4,752 observations. The CDC uses the following race categorizes to organize COVID-19 related deaths: Hispanic, White, Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, and More than One Race. We could not make any conclusions concerning gender and COVID-19 deaths from the first data set as gender information was not included [8]. We excluded 89 observations from our analysis, as 88 observations were totals for the United States and one observation had a missing field.

We turned again to the CDC for our second analysis because the first CDC data set, while providing information for age, race, and state of residence, did not provide information based on gender [9]. This dataset also covered the time frame for the first eight months of 2020. Out of 1,378 observations within the second data set, 212 observations were excluded from our analysis. These 212 observations included state totals for all genders-all ages, total for male-all ages, total for female-all ages, and total for unknown gender-all ages.

2.2 Hypothesis testing

Statistical analyses were performed with both data sets. We utilized a testing model with dependent variable y and independent variable x_i, where

i = 1, 2,…

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \varepsilon \quad (1)$$

The hypothesis used for our model:

$$H_0: \beta_1 = \beta_2 = \ldots = 0, \text{ and} \quad (2)$$

$$H_A: \text{ at least one of } \beta_i \neq 0. \quad (3)$$

Rejection of H_0 for our model implies that at least one of the independent variables contributes significantly to the model. The F-test we utilized to test the above hypothesis is with $\alpha = 0.05$.

2.3 Data analysis

2.3.1. First analysis model

A visual display of the first CDC-based dataset is provided in Figures 1 through 3 for our first analysis model. These scatterplots show variations between race and deaths, age groups and deaths, and state and deaths. Figure 1 demonstrates that Caucasians have experienced more variation of deaths followed by African Americans, Hispanics, and then Asians. The other races have seen relatively fewer deaths.

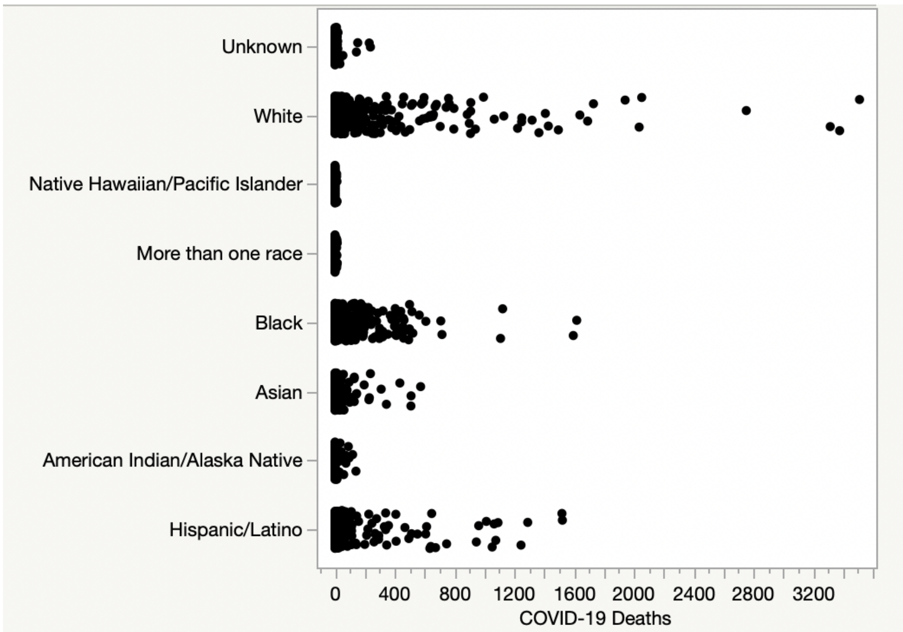

Figure 1: *Race and deaths scatterplot*

Figure 1 confirms what Vahidy *et. al* [6] and Millett *et. al* [7] concluded in their paper: African Americans and Hispanics experienced a relatively higher proportion of deaths in reference to their respective population proportions. Figure 2 demonstrates an increase in the number of deaths as a function of age. Based off of the data, those individuals below the age of 55 have a relatively smaller chance of death from COVID-19 compared to those in age groups of 55 and above.

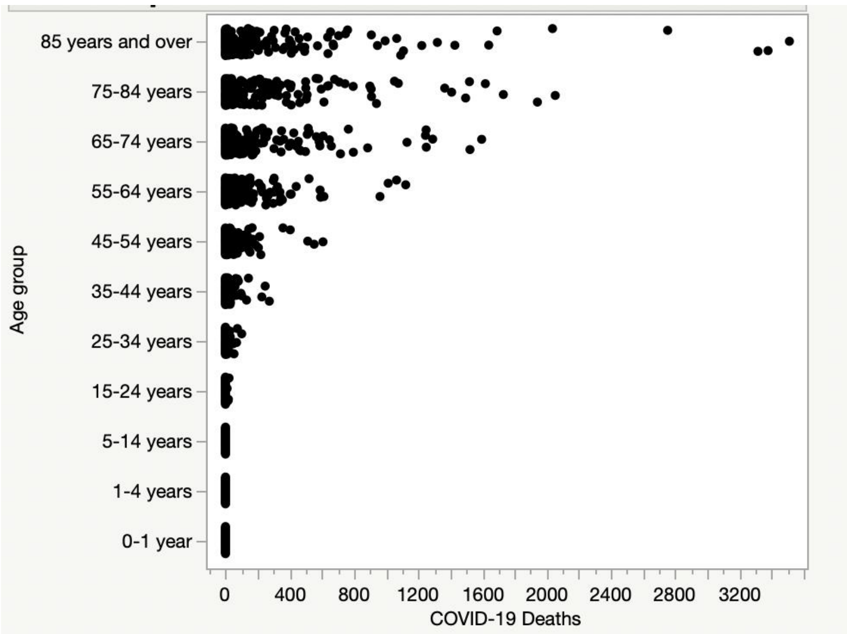

Figure 2: *Age group and deaths scatterplot*

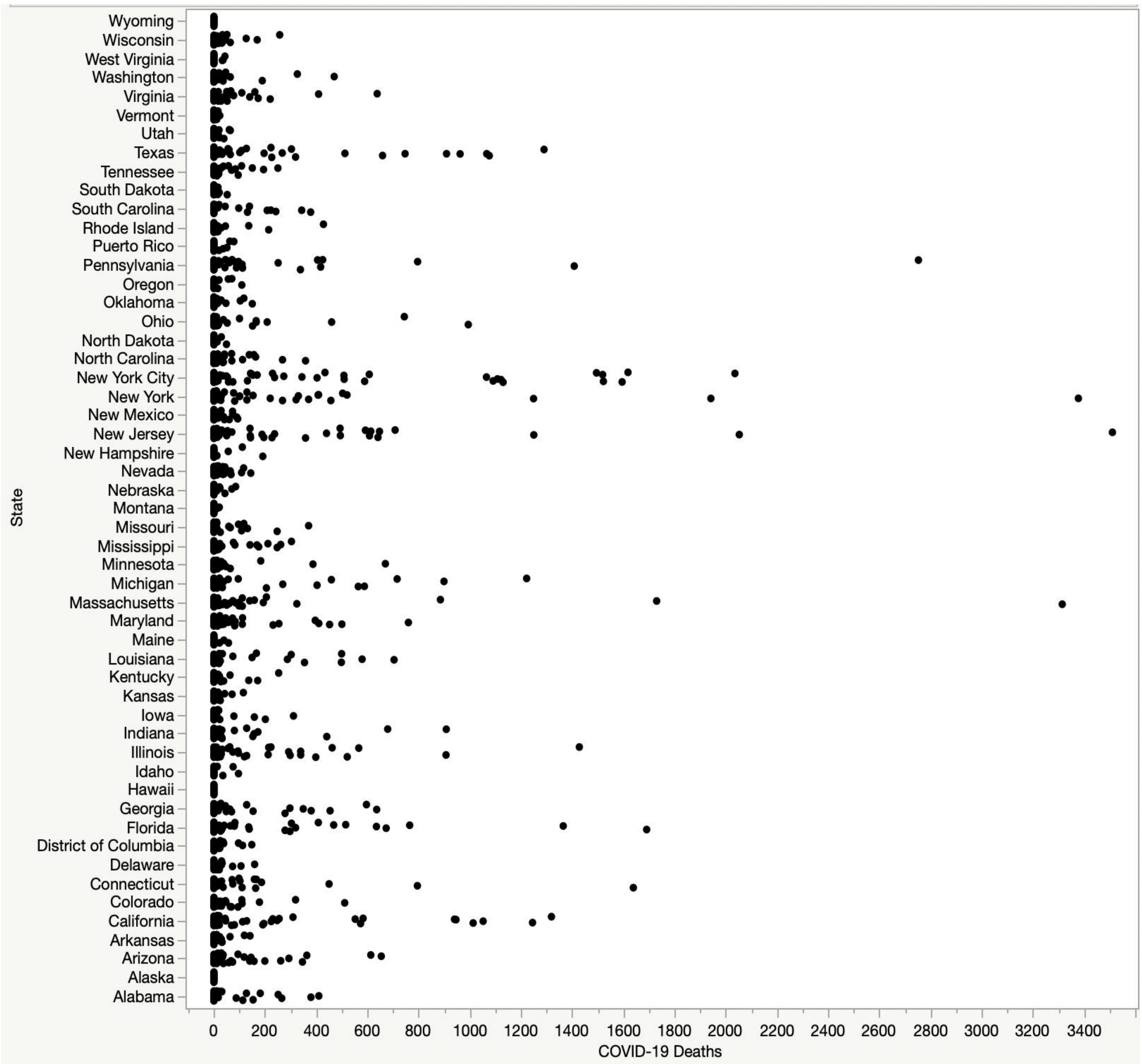

Figure 3: *States and deaths scatterplot*

Lastly, seven states (New Jersey, New York, Michigan, Pennsylvania, Florida, California, and Texas) were found to have a large variation in deaths compared to the other 43 states in the country, as displayed in Figure 3.

Using JMP software, we performed a multiple linear regression analysis. Our model's summary of fit demonstrated an R-squared adjusted value of 0.2884. The analysis of variance of the full model is shown in Table 1. Our overall model was shown to be significant with a p-value of < 0.0001. This means that our regression model is better than just using a mean value to predict deaths. Table 2 shows that all individual sources of state, race, and age groups are significant with COVID-19 deaths as each has a p-value < 0.0001. The parameter estimates for the first model are tabulated in Appendix A. Analyzing Appendix A for the p-values (last column of 'prob > |t|'), we can conclude that all age groups are significant to the regression model. In addition, all races are significant to the regression model, with the exception of African Americans with a p-value > 0.05. Only a few states are significant to the regression model (California, Florida, Illinois, New York, Ohio, Pennsylvania, and Texas) with p-value < 0.05. All the remaining states are not significant to the regression model with p-value > 0.05.

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Table 1: *ANOVA table – 1st data set*

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	69	3977597530	57646341	19.4363
Error	3069	9102394794	2965915.5	Prob>F
C. Total	3138	53345747		<0.0001

Table 2: *Effect tests – 1st data set*

Source	DF	Sum of Squares	F Ratio	Prob>F
State	52	712786798	4.6217	<0.0001
Race	7	2149564759	103.5366	<0.0001
Age Group	10	1095127346	36.9238	<0.0001

Figure 4 shows the normalized residuals vs. predicted deaths for the first CDC data set-based model. There are many outliers, as several of the points do not fall within a -3 to +3 range for predicted deaths higher than 3,000.

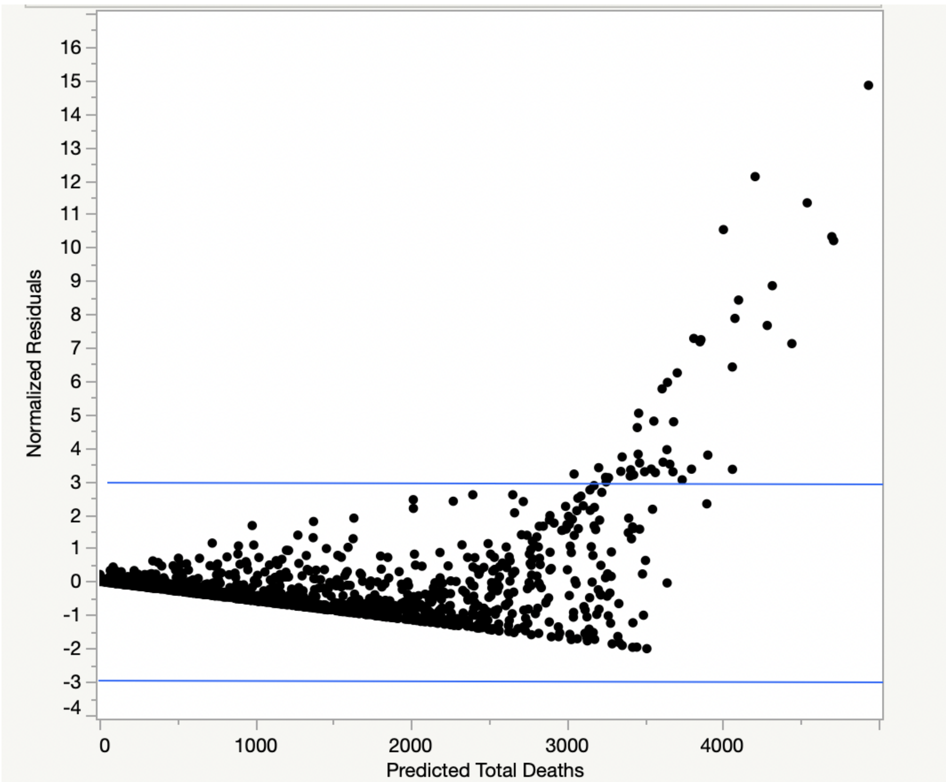

Figure 4: *Normalized residuals plot*

2.3.2. Second analysis model

For our second model, multiple regressions were performed using the second CDC data set. This model included age groups, gender, and state of residence with respect to COVID-19 deaths. A visual display of our CDC-based second dataset is provided in Figures 5 through 7 for this analysis model. These scatterplots show variations between age groups and deaths, gender and deaths, and state of residence and deaths. Figure 5 demonstrates that both males and females experienced a similar variation in deaths.

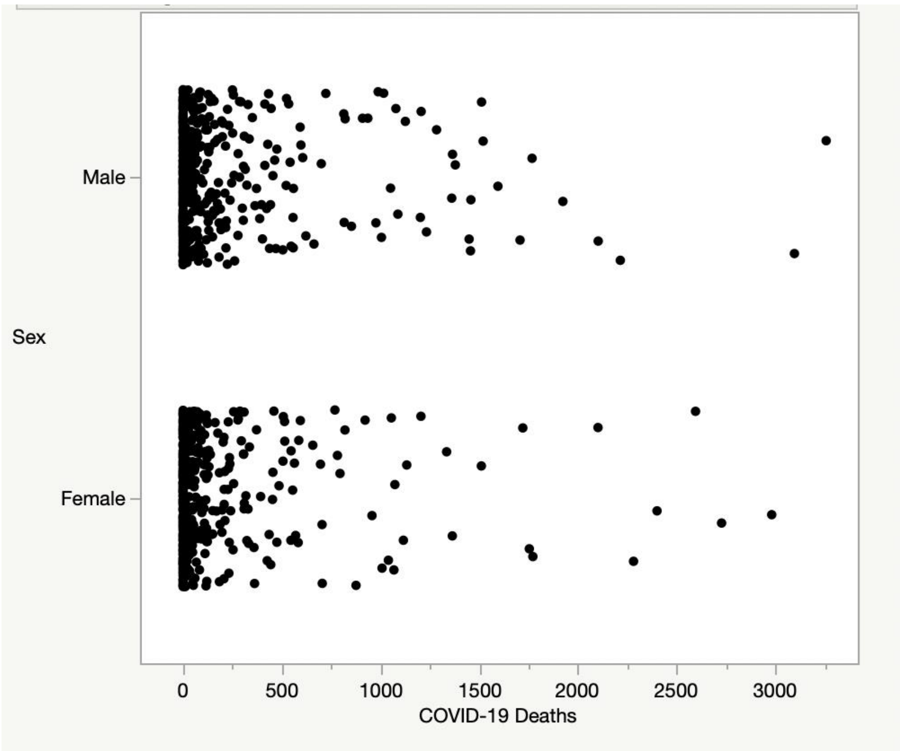

Figure 5: *Gender and deaths scatterplot*

Figure 6 demonstrates an increase in the number of deaths as a function of age similar to the first data set shown in Figure 2. We reached the same conclusion that those individuals below the age of 55 have a relatively smaller chance of death in comparison to age groups of 55 and above.

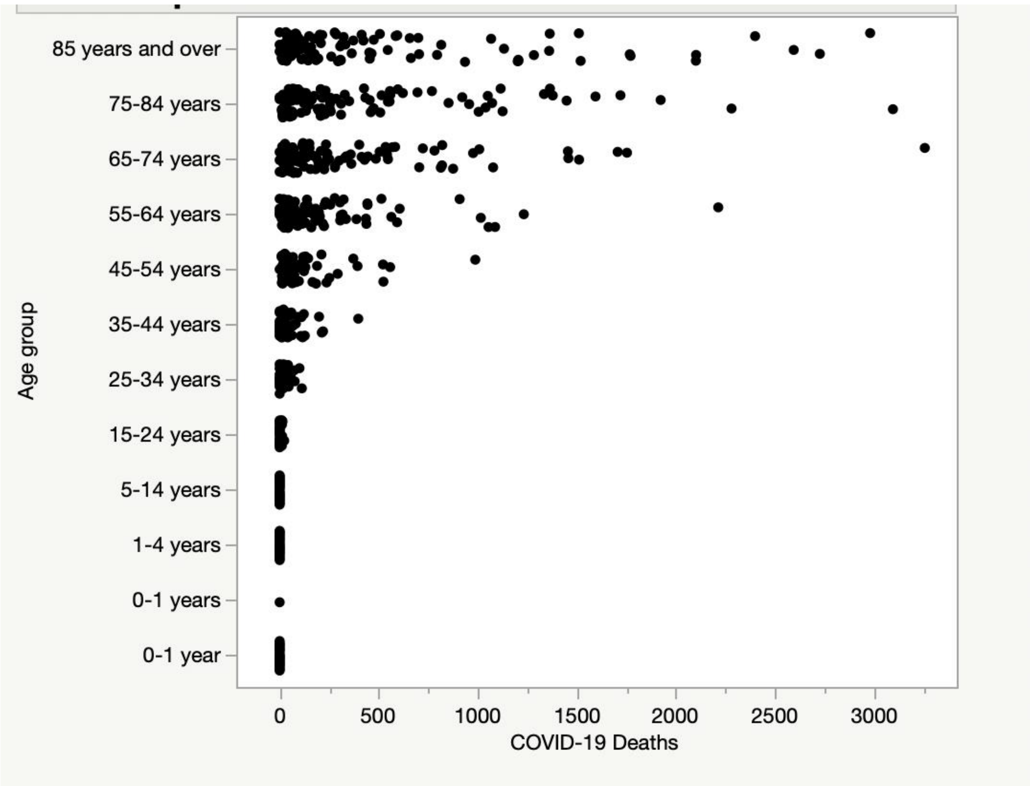

Figure 6: *Age groups and deaths scatterplot*

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From Figure 7, similar to Figure 3, seven states (New Jersey, New York, Michigan, Pennsylvania, Florida, California, and Texas) have a large variation in deaths compared to the other 43 states.

Table 3 shows the analysis of variance for the overall regression model for our second CDC data set. This was found to be significant with a p-value of <0.0001.

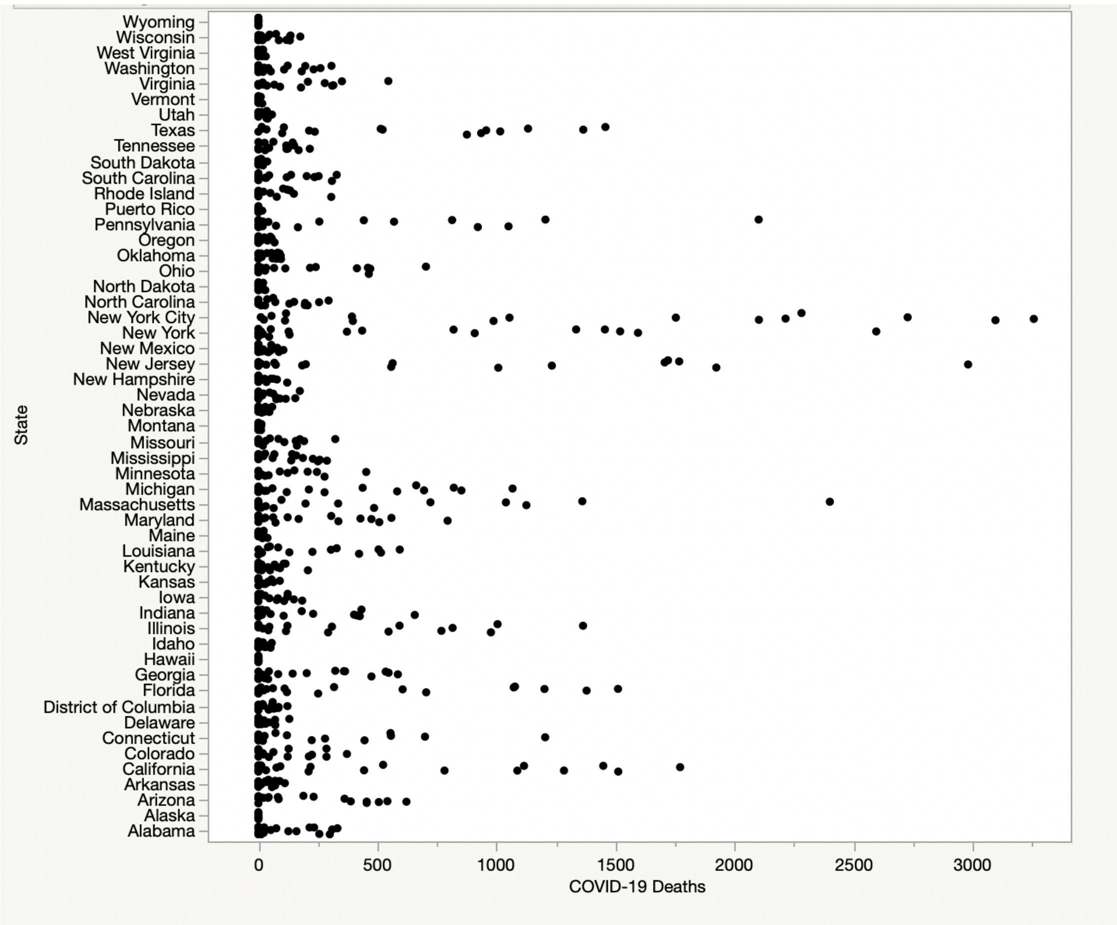

Figure 7: *States and deaths scatterplot*

These results show that our regression model is better than just using a mean value to predict deaths. The model had a R-squared adjusted value of 0.5437, thus displaying a better fit than our first model. Table 4 for this analysis demonstrates that age groups and states of residence are statistically significant (p-value < 0.05), while gender is not. Parameter estimates are tabulated in Appendix B. Analyzing Appendix B for the p-values (last column of 'prob > |t|') we can conclude that all age groups are significant to the regression model except the age groups of 1-4 years and 55-64 years as they both have p-value > 0.05. Unlike our first model, in this model most states that are significant to the regression model with p-value < 0.05. The states of Georgia, Hawaii, Indiana, Louisiana, Maine, Maryland, Minnesota, Mississippi, Missouri, Montana, North Carolina, Ohio, South Carolina, Tennessee, Vermont, Virginia, and Washington are not significant to the regression model with p-value >0.05.

Table 3: *ANOVA table – 2nd data set*

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	64	81481251	1273145	17.6413
Error	830	59899942	72169	Prob>F
C. Total	894	141381193		<0.0001

Table 4: *Effect tests – 2nd data set*

Source	DF	Sum of Squares	F Ratio	Prob>F
Age group	11	32720764	41.22	<0.0001
State	52	49309527	13.14	<0.0001
Sex/Gender	1	254763	3.53	0.0606

In Figure 8 we show the normalized residuals vs. predicted deaths for the second CDC data set. There are no outliers, as none fall outside the -3 to +3 range.

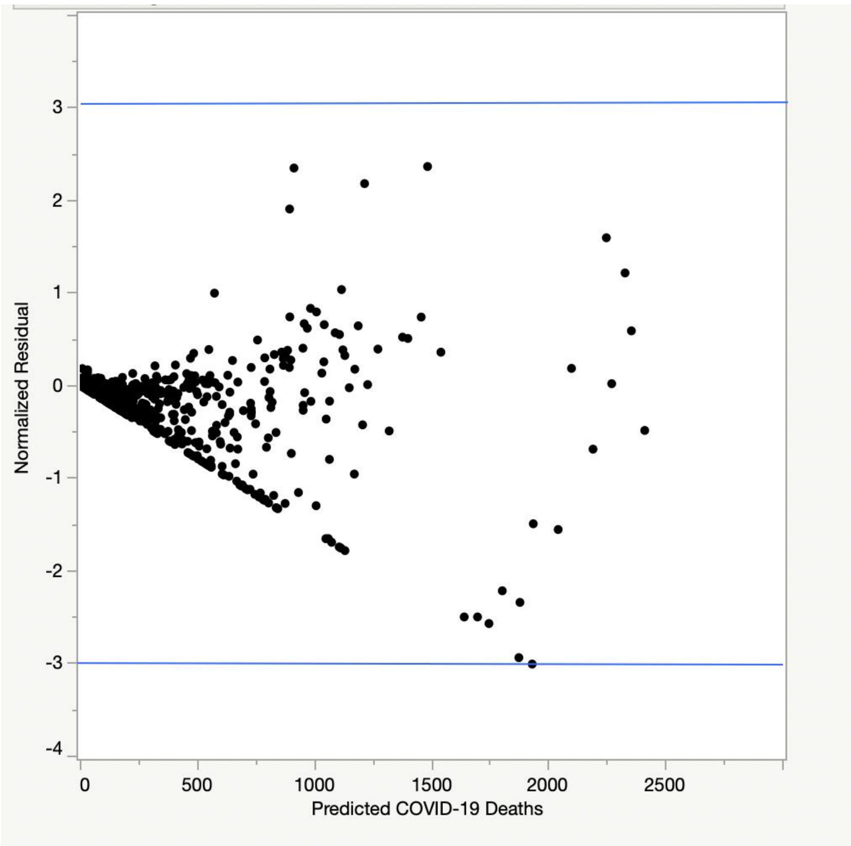

Figure 8: *Normalized residuals plot*

3 Social Implications

3.1 Socio-economic drivers

First, we propose Qualitative socio-economic Logic based Cascade Hypotheses (QLCH) related to education, occupation, and income. Second, we extend these four socio-economic hypotheses to 'COVID-19 deaths related to race' hypotheses. We next look at various US government's socio-economic data of education, occupation, income, and where a person lived in reference to race/ethnicity to validate these hypotheses.

3.1.1 Qualitative socio-economic Logic based Cascade Hypotheses (QLCH) for a race

We propose the following Qualitative socio-economic Logic based Cascade Hypotheses:

QLCH1: A race with lower Highschool dropouts and higher Highschool completions will have higher college enrollments and college education completions and vice versa.

QLCH2: A race with higher college enrollment will have higher Bachelor's degrees awarded in STEM (Science, Technology, Engineering, and Mathematics) fields and vice versa.

QLCH3: A race with higher numbers of Bachelor's degrees awarded in STEM fields will have higher proportions of Management/professional jobs instead of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) and vice versa.

QLCH4: A race with a higher proportion of Management/professional jobs instead of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) will earn higher median incomes and vice versa.

3.1.2 Qualitative socio-economic Logic based Cascade Hypotheses (QLCH) to COVID-19 for a race

Next, we extend the four socio-economic hypotheses (QLCH1-4) to 'COVID-19 deaths related to race' hypotheses as follows:

QLCH5: A race with higher median incomes will have higher percentage of private health coverage and vice versa.

QLCH6: A race with higher proportions of Management/professional jobs instead of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) have a better capacity to social distance by working from home and vice versa.

QLCH7: A race with higher proportions of Management/professional jobs instead of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) have a better capacity to social distance by living in non-crowded neighborhoods like suburbs instead of cities and vice versa.

QLCH8: A race with higher proportions of living in non-crowded neighborhoods like suburbs instead of cities will have better healthcare access and vice versa.

3.2 Socio-economic data for the U.S.

In Tables 5 through 9 we display socio-economic data from various U.S. Government reports. Then for each table we verify if the data follows our various hypotheses.

In Table 5 we summarize data from the U.S. Department of Education's National Center for Education Statistics for 2016 [10]. Asians performed the best in all categories with lowest Highschool dropout rate of 2%, highest Highschool completion rate of 97% and highest full time job holders of 80%, highest college enrollment rate of 58%, and highest Bachelor's degrees awarded in STEM (Science, Technology, Engineering, and Mathematics) fields of 33%. Both Blacks and Hispanics were the bottom two races when it came to Highschool graduations, college enrollments, and receiving Bachelor's degrees in STEM fields.

Table 5: *Graduation and jobs percentages by race in the US - 2016*

	Percentage			
	White	Black	Asian	Hispanic
Highschool dropout rate	5	6	2	9
Highschool completion rate	94	92	97	89
Highschool dropouts who are full time job holders	58	39	78	65
Highschool graduates who are full time job holders	68	66	80	72
College enrollment rate	42	36	58	39
Bachelor's degrees awarded in STEM* fields	18	12	33	15

*STEM: Science, Technology, Engineering, and Mathematics

The QLCH1 and QLCH2 appear to apply well as shown in Table 5 to all four races and profoundly to Asians with lower Highschool dropouts, higher Highschool graduations, higher college enrollments, and higher Bachelor's STEM degrees awarded. In Table 6, we display employment by occupation, gender, and race from the U.S. Bureau of labor statistics report for 2019 [11]. Note that the estimates for the race groups do not sum to totals, as data are not presented for all races and those people whose race is identified as Hispanic may be of any race. Both Asians and Whites hold proportionally more Management or Professional jobs than their population proportions (8.7% vs. 6.5% for Asians and 79% vs. 77.7% for Whites) while both Blacks and Hispanics hold proportionally fewer Management or Professional jobs than their population proportions (9.6% vs. 12.3% for Blacks and 10.1% vs. 17.6% for Hispanics). The opposite is true for 'Service' occupation as both Blacks and Hispanics hold proportionally higher Service jobs than their population proportions (17.1% vs. 12.3% for Blacks and 25% vs. 17.6% for Hispanics) while both Asians and Whites hold proportionally fewer Service jobs than their population proportions (5.9% vs. 6.5% for Asians and 72.2% vs. 77.7% for Whites). For the 'Sales and office' occupation, only Asians have lower proportional employment than their population proportion (5.2% vs. 6.5%) while the other three races' proportional employments represent their individual population proportions. For the occupations of Natural resources, construction, and maintenance, Whites and Hispanics overrepresent while Blacks and Asians underrepresent their individual population proportions. For the occupations of Production, transportation, and material, Blacks and Hispanics overrepresent while Whites and Asians underrepresent their population proportions.

Thus, the data in Table 6 shows that all races do follow QCH3. Asians and Whites with higher percentage of STEM degrees hold higher proportions of Management/professional jobs and lower proportions of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) while Blacks and Hispanics with lower percentage of STEM degrees hold lower proportions of Management/professional jobs and higher proportions of Service jobs as compared to their respective population proportions.

Table 6: *U.S. Bureau of labor statistics - 2019*

Occupation	M, Total employed	Percent of total employed					
		Female	Male	White	Black	Asian	Hispanic
Total (16 years and over)	157.5	47.0	53.0	77.7	12.3	6.5	17.6
1) Management/professional and related	64.2	51.8	48.2	79.0	9.6	8.7	10.1
2) Service: Total	27.0	57.6	42.4	72.2	17.1	5.9	25.0
2.1) Healthcare support	3.8	86.9	13.1	64.2	26.7	5.1	19.1
2.2) Protective service	3.1	22.1	77.9	73.9	20.3	2.2	15.3
2.3) Food preparation and serving related	8.4	54.5	45.5	73.7	13.9	6.9	27.0
2.4) Building and grounds cleaning and maintenance	5.7	42.0	58.0	77.3	14.9	2.9	38.2
2.5) Personal care and service	6.0	76.9	23.1	69.4	16.1	10.1	18.2
3) Sales and office	33.4	60.6	39.4	78.1	13.0	5.2	17.1
4) Natural resources, construction, and maintenance	14.3	5.4	94.6	86.2	7.7	2.2	31.9
5) Production, transportation, and material	18.6	23.0	77.0	74.2	16.9	5.0	23.0

In Table 7, we display health insurance coverage by race in the United States for 2018 from the census report [12]. Note that Hispanic data may overlap with data for race groups as Hispanics can be of any race. Both Whites and Asians have higher health care coverage percentages (94.6% and 93.2% respectively) including higher private insurance coverage (74.8% and 73.1% respectively). In contrast, both Blacks and Hispanics have lower health care coverage percentages (90.3% and 82.2% respectively) including significantly lower private insurance coverage (55.4% and 49.6% respectively). Relatively speaking, both Blacks and Hispanics have considerably higher public insurance coverage (41.2% and 36.5% respectively) than both White and Asians (33.2% and 26.1%)

For all four races QLCH5 applies well as described in Table 7. Asians and Whites with higher median incomes have higher percentage of private health coverage while Blacks and Hispanics with lower median incomes have lower percentage of private health coverage or higher percentage of public health coverage.

Table 7: *Health Insurance Coverage in the United States - 2018*

Coverage	Percentage			
	White	Black	Asian	Hispanic
Health insurance coverage	94.6	90.3	93.2	82.2
Private insurance coverage	74.8	55.4	73.1	49.6
Public insurance coverage	33.2	41.2	26.1	36.5

Table 8: *Life expectancy by race - 2017*

Age	Life expectancy in years			
	All races	White	Black	Hispanic
At birth	78.6	78.5	74.9	81.8
At age of 55 years	27.4	27.3	25.2	29.8

In Table 8, we show CDC's life expectancy data by race at birth and at age of 55 years for 2017 [13]. Blacks had the lowest life expectancy both at birth and at age of 55 (74.9 and 25.2 respectively), while Hispanics had the highest life expectancy (81.8 and 29.8 respectively).

In Table 9 we display real median household income from the U.S. Census Bureau's Current Population Survey [14]. Asians had the highest median income of $81,400 for 2017, followed by Whites, Hispanics and Blacks of $68,200, $50,500, and $40,300 respectively. Blacks faired the worst with no real median income growth from 2002 to 2017 while Asians had the highest growth gains of 0.82% annually over the same period.

Table 9: *Real median household income by race in 2017 dollars*

Year	Median income				
	All races	White	Black	Asian	Hispanic
2017	$61,400	$68,200	$40,300	$81,400	$50,500
2002	$58,000	$64,500	$40,300	$72,000	$45,000
1987	$53,000	$57,500	$32,000	$67,000	$40,000
2002-2017 Annual Growth	0.38%	0.37%	**0.00%**	0.82%	0.77%

Table 10: *Real median household income relative to Asian race*

Year	Median income				
	All races	White	Black	Asian	Hispanic
2017	0.75	0.84	0.50	1.00	0.62
2002	0.81	0.90	0.56	1.00	0.63
1987	0.79	0.86	0.48	1.00	0.60
Average	0.78	0.87	0.51	1.00	0.62

From Table 9, we converted real median household income standardized in terms of Asian median income which is shown in Table 10. Over a 30 year period from 1987 to 2017, Blacks made 51 cents on a dollar, Hispanics made 62 cents on a dollar, and Whites made 87 cents on a dollar when compared to Asians. Thus, the data shows that QLCH4 applies well to all four races as described in Table 9 and Table 10. Asians and Whites with a higher proportion of Management/professional jobs instead of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) earn higher median incomes, while Blacks and Hispanics with a lower proportion of Management/professional jobs instead of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) earn lower median incomes.

3.3 Socio-economic implications of race and location of living to COVID-19

Applying QLCH6, Asians and Whites with higher proportions of Management/professional jobs instead of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) do have better capacity to social distance by working from home while the opposite will be true for Blacks and Hispanics.

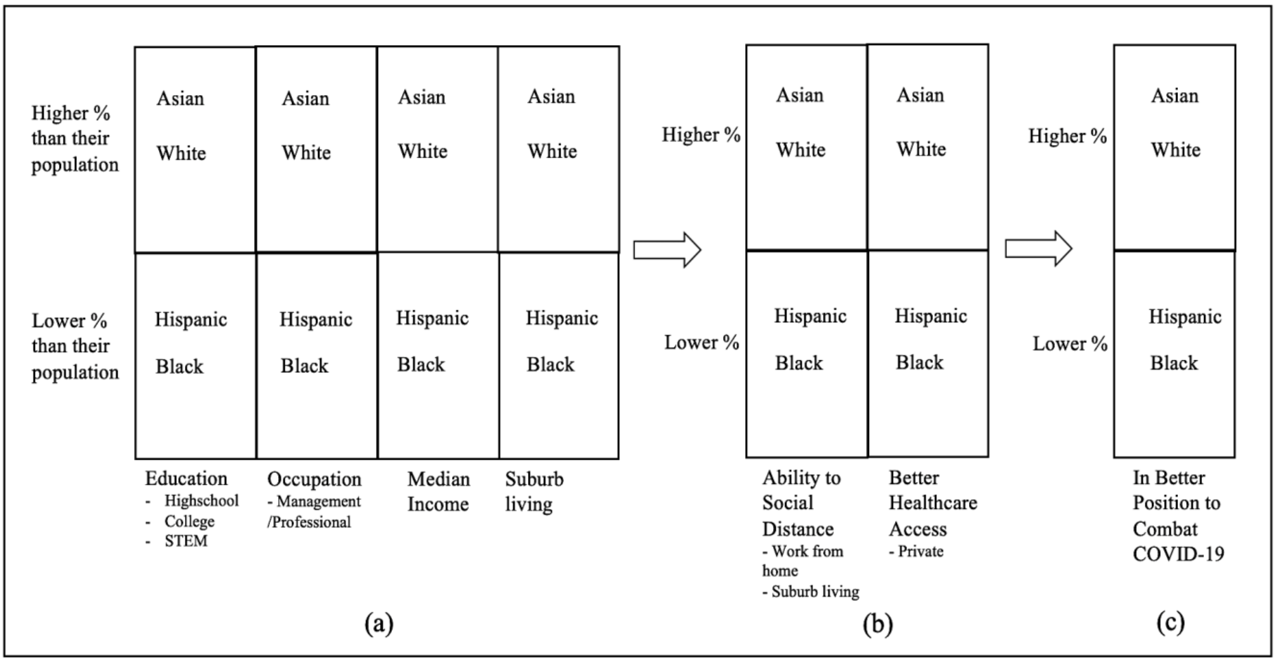

Figure 9: *Race/ethnicity based socio-economic implications for COVID-19*

Considering QLCH7, Asians and Whites with higher proportions of Management/professional jobs instead of Service jobs (including essential work of hospitals/transportation/farm/grocery stores jobs) do have better capacity to social distance by living in non-crowded neighborhoods like suburbs instead of cities while the opposite is applicable to Blacks and Hispanics.

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Utilizing QLCH8, Asians and Whites with higher proportions living in non-crowded neighborhoods, such as more suburban areas, have better healthcare access compared to Blacks and Hispanics. Figure 9 summarizes race/ethnicity based socio-economic implications for COVID-19. In Figure 9(a) Asians and Whites in relation to Hispanics and Blacks have higher percentages in education including STEM degrees which leads to higher percentages in Management/professional jobs instead of Service/essential jobs, thus additionally leading to higher median incomes. Higher median incomes for these two races give them the choice of living in more suburban areas. This allows higher percentage of Asians and Whites, in comparison with Hispanics and Blacks, the ability to social distance by living in suburbs as well as working from home (i.e. being of Management/professional occupation instead of being Service/essential workers as shown Figure 9(b)). This leads to Asians and Whites being better positioned to combat COVID-19 as displayed in Figure 9(c).

3.4 Comparison of regression analyses with socio-economic analysis

Our two regression analyses summarized in Table 2 and Table 4 showed that where you live (state) and race are statistically significant with COVID-19 deaths for the US population. These quantitative regression analyses are in concert with our QLCH based analyses conclusions for both race/ethnicity and where you live described in Figure 9. Tables 5 through 9 support these conclusions for the US population.

4 Conclusions

In the United States, deaths caused by infectious diseases have significantly reduced over the last 40 years due to better vaccines, therapeutics, and healthcare system improvements. However, in the first eight months of 2020, infectious disease has once again become a significant cause of death in the US. COVID-19 caused deaths have already exceeded the 170,000 deaths due to accidents in 2017. Unfortunately, this year COVID-19 caused deaths will be the third leading cause of deaths behind heart disease and cancer. Demographic factors of age groups, race, and residence state were found to be statistically significant using multiple regression analysis. The second analysis, with factors of age groups, gender, and residence state had a better R-squared adjusted score and no outliers. The virus is an equal opportunist as it affects both genders equally. However, the age of an individual is a critical variable that decides life or death, especially for individuals in age groups of 55 and above. Race also seems to play an important role in deaths, as Black and Hispanic death proportions are higher than their respective population proportions. Bigger population states with high minority populations have seen higher deaths relative to the other states. Thus, inequality in socio-economic conditions is an important determinant affecting health conditions of an individual and his/her ability to social distance at work or at home. Socio-economic analysis for the US population shows that QLCH of education, occupation, and income affects race differently. For a given race, education drives occupation then income, where a person lives, and in turn his/her access to healthcare coverage. Considering US socio-economic data in the QLCH framework, we conclude that different races are poised for differing effects of COVID-19. In particular, Asians and Whites are in a better position to combat COVID-19 when compared to Hispanics and Blacks.

5 Competing Interests

The author declared that no conflict of interest exists in this publication.

How to Cite this Article:

Kulkarni, S. S., & Lorenz, K. E. (2020). Social Implications of COVID-19 Deaths: Analyzing Race, Ethnicity, Socio-Economic Conditions, Gender, and Age for the US. *Advanced Journal of Social Science*, *7*(1), 163-180. https://doi.org/10.21467/ajss.7.1.163-180

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Appendix A

Parameter estimates for data set 1 (COVID-19 Deaths, Race, Age, and Residence State)

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	360.01612	31.78554	11.33	<.0001*
Age group[1-4 years]	-348.9833	99.29363	-3.51	0.0004*
Age group[5-14 years]	-413.4143	98.94505	-4.18	<.0001*
Age group[15-24 years]	-535.0643	101.3903	-5.28	<.0001*
Age group[25-34 years]	-438.4357	99.2866	-4.42	<.0001*
Age group[35-44 years]	-370.6011	98.26482	-3.77	0.0002*
Age group[45-54 years]	-218.8812	98.7826	-2.22	0.0268*
Age group[55-64 years]	200.33491	95.02926	2.11	0.0351*
Age group[65-74 years]	581.47702	93.64987	6.21	<.0001*
Age group[75-84 years]	837.96633	93.24615	8.99	<.0001*
Age group[85 years and over]	1231.4153	96.24568	12.79	<.0001*
State[Alabama]	-77.63695	236.7255	-0.33	0.7430
State[Alaska]	-487.5817	257.1843	-1.90	0.0581
State[Arizona]	61.520221	207.4479	0.30	0.7668
State[Arkansas]	-288.1733	224.1363	-1.29	0.1986
State[California]	1587.2543	192.7614	8.23	<.0001*
State[Colorado]	-84.30372	215.4137	-0.39	0.6956
State[Connecticut]	-109.411	226.0923	-0.48	0.6285
State[Delaware]	-314.3935	210.404	-1.49	0.1352
State[District of Columbia]	-379.1769	226.2469	-1.68	0.0939
State[Florida]	1429.1902	208.9845	6.84	<.0001*
State[Georgia]	293.51314	217.0577	1.35	0.1764
State[Hawaii]	-390.4032	228.4615	-1.71	0.0876
State[Idaho]	-490.6046	266.3785	-1.84	0.0656
State[Illinois]	572.13323	212.1221	2.70	0.0070*
State[Indiana]	135.52949	246.3455	0.55	0.5822
State[Iowa]	-331.4798	234.3755	-1.41	0.1574
State[Kansas]	-339.003	213.6081	-1.59	0.1126
State[Kentucky]	-111.9954	228.0869	-0.49	0.6234
State[Louisiana]	-91.52579	222.2892	-0.41	0.6806
State[Maine]	-230.0137	260.2624	-0.88	0.3769
State[Maryland]	43.550675	222.3329	0.20	0.8447
State[Massachusetts]	139.19579	222.2489	0.63	0.5312
State[Michigan]	347.7591	203.0051	1.71	0.0868
State[Minnesota]	-96.84952	210.4423	-0.46	0.6454
State[Mississippi]	-221.6929	213.5928	-1.04	0.2994
State[Missouri]	35.187439	230.2232	0.15	0.8785
State[Montana]	-389.1593	246.282	-1.58	0.1142
State[Nebraska]	-454.0713	238.9378	-1.90	0.0575
State[Nevada]	-304.8371	207.402	-1.47	0.1417
State[New Hampshire]	-247.9574	228.3482	-1.09	0.2776
State[New Jersey]	353.86011	205.815	1.72	0.0857
State[New Mexico]	-300.1473	236.5608	-1.27	0.2046
State[New York]	498.22816	205.85	2.42	0.0156*
State[New York City]	391.64124	205.8526	1.90	0.0572
State[North Carolina]	154.38436	226.2345	0.68	0.4950
State[North Dakota]	-377.2896	266.7331	-1.41	0.1573
State[Ohio]	595.35996	211.9688	2.81	0.0050*
State[Oklahoma]	-220.6332	218.7907	-1.01	0.3133
State[Oregon]	-321.5502	222.4441	-1.45	0.1484
State[Pennsylvania]	701.6384	216.9855	3.23	0.0012*

Appendix A (Continued)

Parameter estimates for data set 1 (COVID-19 Deaths, Race, Age, and Residence State)

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
State[Puerto Rico]	-84.54152	210.7326	-0.40	0.6883
State[Rhode Island]	-360.2246	238.8367	-1.51	0.1316
State[South Carolina]	-39.46276	226.2875	-0.17	0.8616
State[South Dakota]	-463.4097	270.0065	-1.72	0.0862
State[Tennessee]	233.47742	220.5326	1.06	0.2898
State[Texas]	1205.3909	204.4877	5.89	<.0001*
State[Utah]	-343.9522	212.0879	-1.62	0.1050
State[Vermont]	-225.7713	226.4077	-1.00	0.3188
State[Virginia]	111.15461	208.9873	0.53	0.5949
State[Washington]	-7.673756	204.5626	-0.04	0.9701
State[West Virginia]	-292.3035	232.366	-1.26	0.2085
State[Wisconsin]	-49.09047	208.906	-0.23	0.8142
Race and Hispanic Origin Group[Hispanic or Latino]	-132.6249	78.42269	-1.69	0.0909
Race and Hispanic Origin Group[Non-Hispanic American Indian or Alaska Native]	-359.6235	85.24763	-4.22	<.0001*
Race and Hispanic Origin Group[Non-Hispanic Asian]	-458.4406	85.20563	-5.38	<.0001*
Race and Hispanic Origin Group[Non-Hispanic Black]	38.745663	78.39213	0.49	0.6212
Race and Hispanic Origin Group[Non-Hispanic More than one race]	-492.1466	97.60621	-5.04	<.0001*
Race and Hispanic Origin Group[Non-Hispanic Native Hawaiian or Other Pacific Islander]	-231.8993	86.87854	-2.67	0.0076*
Race and Hispanic Origin Group[Non-Hispanic White]	1914.6453	71.81321	26.66	<.0001*

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Appendix B

Parameter estimates for data set 2 (COVID-19 Deaths, Gender, Age, and Residence State)

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	137.50478	24.66428	5.58	<.0001*
Age group[0-1 year]	-108.6182	35.96112	-3.02	0.0026*
Age group[0-1 years]	69.424896	255.051	0.27	0.7855
Age group[1-4 years]	-102.3781	35.32998	-2.90	0.0039*
Age group[5-14 years]	-92.44816	36.09333	-2.56	0.0106*
Age group[15-24 years]	-142.5651	43.01761	-3.31	0.0010*
Age group[25-34 years]	-265.544	45.92898	-5.78	<.0001*
Age group[35-44 years]	-189.073	40.14644	-4.71	<.0001*
Age group[45-54 years]	-77.42031	37.51859	-2.06	0.0394*
Age group[55-64 years]	61.097229	35.61192	1.72	0.0866
Age group[65-74 years]	205.4369	35.31336	5.82	<.0001*
Age group[75-84 years]	278.88484	34.91804	7.99	<.0001*
State[Alabama]	-45.16775	59.63348	-0.76	0.4490
State[Alaska]	-53.3162	74.03375	-0.72	0.4716
State[Arizona]	65.30657	61.24001	1.07	0.2866
State[Arkansas]	-167.2869	66.64752	-2.51	0.0123*
State[California]	370.69469	58.30508	6.36	<.0001*
State[Colorado]	-84.88117	64.64704	-1.31	0.1895
State[Connecticut]	57.82471	64.64704	0.89	0.3713
State[Delaware]	-170.5994	66.64752	-2.56	0.0107*
State[District of Columbia]	-147.4725	64.6136	-2.28	0.0227*
State[Florida]	297.93896	61.26907	4.86	<.0001*
State[Georgia]	53.304542	62.93852	0.85	0.3973
State[Hawaii]	-38.57153	74.0378	-0.52	0.6025
State[Idaho]	-143.9752	64.77727	-2.22	0.0265*
State[Illinois]	249.49477	64.78328	3.85	0.0001*
State[Indiana]	-0.793811	62.85679	-0.01	0.9899
State[Iowa]	-153.9593	68.79619	-2.24	0.0255*
State[Kansas]	-187.0976	68.79329	-2.72	0.0067*
State[Kentucky]	-126.7821	61.1973	-2.07	0.0386*
State[Louisiana]	61.979478	64.74334	0.96	0.3387
State[Maine]	-135.269	68.98617	-1.96	0.0502
State[Maryland]	44.454078	61.19396	0.73	0.4678
State[Massachusetts]	255.03303	61.19396	4.17	<.0001*
State[Michigan]	157.66965	61.2578	2.57	0.0102*
State[Minnesota]	-90.76665	64.6136	-1.40	0.1605
State[Mississippi]	-73.63636	62.87132	-1.17	0.2418
State[Missouri]	-115.7934	64.64829	-1.79	0.0736
State[Montana]	-96.64776	71.26762	-1.36	0.1754
State[Nebraska]	-169.5496	64.68274	-2.62	0.0089*
State[Nevada]	-130.3499	64.61362	-2.02	0.0440*
State[New Hampshire]	-130.4797	64.69638	-2.02	0.0440*
State[New Jersey]	557.09482	59.69921	9.33	<.0001*
State[New Mexico]	-117.8677	59.63348	-1.98	0.0484*
State[New York]	428.88705	59.6943	7.18	<.0001*
State[New York City]	1119.8678	66.87858	16.74	<.0001*
State[North Carolina]	-78.60194	61.18439	-1.28	0.1993
State[North Dakota]	-128.2981	64.74855	-1.98	0.0479*
State[Ohio]	5.6261681	64.67627	0.09	0.9307
State[Oklahoma]	-169.9087	68.76992	-2.47	0.0137*
State[Oregon]	-168.4908	64.68274	-2.60	0.0094*
State[Pennsylvania]	244.29618	61.19396	3.99	<.0001*

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Appendix B (Continued)

Parameter estimates for data set 2 (COVID-19 Deaths, Gender, Age, and Residence State)

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
State[Puerto Rico]	-223.887	71.14168	-3.15	0.0017*
State[Rhode Island]	-142.4135	68.85869	-2.07	0.0389*
State[South Carolina]	-77.8835	66.61104	-1.17	0.2426
State[South Dakota]	-164.4586	64.61827	-2.55	0.0111*
State[Tennessee]	-125.5243	68.78903	-1.82	0.0684
State[Texas]	400.8797	64.85037	6.18	<.0001*
State[Utah]	-193.2976	68.79329	-2.81	0.0051*
State[Vermont]	-78.82175	74.08765	-1.06	0.2877
State[Virginia]	-37.39142	61.18439	-0.61	0.5413
State[Washington]	-91.77569	62.81311	-1.46	0.1444
State[West Virginia]	-171.7658	68.87104	-2.49	0.0128*
State[Wisconsin]	-138.1335	66.61104	-2.07	0.0384*
Sex[Female]	-16.95728	9.025317	-1.88	0.0606