Examining the Relationship Between Age of Death, Race/Ethnicity and Education among COVID-19 related deaths in Riverside County, California

by

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Abstract

Since the COVID-19 outbreak in late 2019, it has spread to states in the United States. COVID-19 became the third leading cause of death in the United States in just two years. The data used in this study were obtained from the RUHS-PH using a dataset that included all deaths caused by COVID-19 among Riverside County, California residents from March 2020 to December 2021. one-way ANOVA was used to determine whether there was a relationship between race/ethnicity and age at death. In addition, a multiple regression was used to determine the degree of prediction of age at death by race/ethnicity and education level. It turned out that Whites had the oldest age at death, and American Indian/Alaskan Natives had the earlier age at death. Furthermore, Race was the strongest predictor of age at death compared to education. Compared with all independent variables, the analysis found that Hispanics had the largest effect on age at death. And age at death was not statistically different for those without college degrees compared to those with a college degree.

Key Words: COVID-19, Race, Education, Age at Death, Ethnicity

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Introduction

Overview of the Literature

COVID-19, an emerging infectious disease caused by the novel coronavirus SARS-COV-2, is highly transmissible and pathogenic for humans and can lead to life-threatening illness and mortality (Alcendor, 2020). On December 12, 2019, the first case of COVID-19 was detected in Wuhan, Hubei Province, China (Centers for Disease Prevention [CDC], 2022). On February 29, 2020, the first COVID-19 related death was reported in the United States. Since then, outbreak spreads to states across the U.S. (Bassett, 2020).

COVID-19 became the third leading cause of death in the United States in just two years, behind heart disease and cancer (CDC, 2022). As of March 2022, the United States is the country with the highest number of reported cases, and The Centers for Disease Control and Prevention shows that the U.S. has accumulated more than 80 million cases and nearly 1 million deaths (CDC, 2022).

Governments seek to prevent the spread of the pandemic and save more lives. Non-pharmaceutical interventions have been used, including self-isolation, social distancing and wearing a mask (Chen et al., 2020). The COVID-19 pandemic exacerbated prior deficiencies and inequities in the U.S. health care system. Most notably, the inability of medical centers to match resources to areas of patient need, lack of inpatient beds and emergency departments (EDs) near or over capacity have become the norm. At the same time, the public health system has become shaky in the face of the COVID-19 pandemic, and the problem of inadequate improvements in the health status of the population has been further magnified (Dorsett, 2020).

COVID-19 Mortality

According to Corrao et al. (2021), After adjusting for age, the United States, although having the highest number of deaths, does not have the highest mortality rate. Belgium has 1.5 times the mortality rate of the United States, the UK has 1.3 times the mortality rate of the United States, and Spain has 1.1 times the mortality rate of the United States. Since the criteria for COVID-19 mortality vary between countries and regional and population distribution variability, specific localities should be discussed.

In the United States, there are significant health disparities, including age, cause of death, race, sex, education, marital status, and occupation. Among these, age, race, and education were particularly evident as risk factors for COVID-19 mortality (Bassett, 2020).

COVID-19 was a new and sudden emerging infectious disease, causing an extremely high rate of morbidity and mortality in the early stages of COVID-19 outbreaks. In United States, COVID-19 mortality and infection rates are not static. Until January 2021, COVID-19 infection and mortality rates continued to skyrocket until widespread vaccination, and a series of preventive policies were implemented to bring them under control (CDC, 2022). In April 2021, COVID-19 variants, such as Delta emerged in the United States, at which point infection and mortality rates revert to geometric growth. The Omicron variant was monitored across the U.S. in December 2021 and continues to be the dominant variant in the United States into the year 2022 (CDC, 2022). We cannot predict when the next mutation and large-scale outbreak of COVID-19 will occur, nor can we know how much harm COVID-19 will

cause to people when it mutates, but continuous monitoring and active prevention are essential.

Age Disparities

Clinical evidence shows that the risk of COVID-19 mortality is strongly associated with age and age has been identified as an independent risk factor for COVID-19 mortality (Ho, 2020). COVID-19 significantly impacts older individuals and those with comorbidities, while younger individuals are often spared (Sasson, 2021).

In the United States, children are better protected against COVID-19(Ioannidis & Contopoulos, 2020). Compared to adults, the course of COVID-19 infection in children is more benign, and even many infected children are completely asymptomatic (Suratannon et al., 2020) According to current data, COVID-19 shows a lower mortality rate among children under 12 years of age and the lowest mortality rate in children 7-9 years of age. Researchers had identified the angiotensin-converting enzyme-2 (ACE2) to be the receptor for COVID-19 virus entry into humans. COVID-19 virus enters the body through ACE2 and binds to it to trigger infection and produce an inflammatory response (Samavati & Uhal, 2020). Children have a lower ACE2 expression level compared to adults and have a strong innate immune system that is better able to cope with the virus when it enters the organism (Ioannidis & Contopoulos, 2020).

In adults over 20 years of age, the proportion of total deaths steadily increases with age for COVID-19. The incidence of common symptoms and the rate of mortality are much higher in adults than in children (Khera et al., 2020). One of the

more critical aspects is the immune response that activates the coagulation system may lead to thrombosis which is a major risk factor for death in adults, however this does not generally occur in children who have a lower prevalence of thrombosis (Suratannon et al., 2020).

Age is the greatest factor influencing older adults' susceptibility to more severe COVID-19 and higher mortality (Gimeno et al., 2021). The study by Ioannidis and Contopoulos (2020) showed, unsurprisingly, that in a comparison of 10 Western countries, the United States and Canada, the vast majority of victims from COVID-19 were above 65 years old, with Switzerland even exceeding 90%, while the lowest rate was in the state of Georgia in the US, exceeded 70%. However, in the age group of 80 years and above, the proportion of deaths exceeded 55% in all 12 countries, with France accounting for 75%. According to Guilmoto's report (2020), regardless of gender, mortality rates tend to increase about 10 -fold every 20 years of age, starting at age 20, to 14 at 40, 127 at 60 and peaking 1388 at 80 years of age (Guilmoto, 2020). As age increases, defects in T and B cell function increase, resulting in increases viral replication and prolonged pro-inflammatory response. This highlights the need for targeted prevention and early detection strategies in older age groups (Jain et al., 2020).

Disparities in Education

The idea that education is associated with better health has been repeatedly demonstrated in many countries, and education imparts specific knowledge and skills, teaching people to think logically, solve problems, and implement plans (Kingston et al., 2003). In general, people with higher education are better educated, leading them

to have stable and well-paying jobs. The increased income can help them afford high-quality medical services, pay for nutritious food, and have better housing conditions. (Mirowsky & Ross, 2003) In addition, higher education promotes healthy lifestyles. They use their knowledge, information, and experience to increase healthy behaviors and reduce health-related risk factors, including a good schedule, frequent physical exercise, as well as positive and optimistic attitude. (Luy et al., 2019).

The Centers for Disease Control and Prevention (CDC) has described a range of risk factors for COVID infection and death including poverty, overcrowding, and chronic disease, which are strongly associated with education levels (Concepción et al., 2020). A study in the United States showed that patients with less education had the highest death rate from COVID-19, while those with a bachelor's degree had the lowest death rate from COVID-19. (Yoshikawa & Asaba, 2021). In the U.S., regardless of occupation, less educated individuals are more likely to be socioeconomically disadvantaged, with lower income levels and precarious work conditions increased risk of infection and death from COVID-19, such as overcrowded households, multigenerational living, and high-risk jobs that make it difficult to maintain social distancing (Matthay et al, 2021).

On the other hand, vaccines have been shown to be effective in preventing COVID-19 infection and death (Christie, 2021). A person's level of education plays a significant role in their assessment of the risk of vaccine effectiveness and side effects and directly influences the decision to vaccinate (Case & Deaton, 2021). According to a Center for Economic and Social Research (CESR) study, only 53% of U.S. adults without a college degree have received or plan to receive the COVID-19 vaccine.

Compared to more than 76% of U.S. adults with a bachelor's degree or higher. (Case & Deaton, 2021).

In addition, chronic diseases are risk factors for COVID-19 related mortality. As a chronic condition, hypertension accounts for most deaths, while other chronic diseases such as heart disease, cardiovascular disease, diabetes, and obesity are also fatal (Zhang, 2020). Educational level is associated with some behavioral risk factors, such as alcohol abuse, smoking, high-fat and high-protein diet, and these behavioral risk factors directly lead to chronic diseases (Choi et al., 2011). People with higher education levels can better obtain information to manage their bodies, prevent diseases, and better protect themselves under the COVID-19 pandemic (Case & Deaton, 2021).

Racial and Ethnic Disparities

The impact of COVID-19 on race in the United States is disproportionate. Much of the racial disparity in health stems from the inequality in socioeconomic and material conditions that result from racism in the United States (Xu et al., 2021). Specifically, different racial and ethnic groups are treated unequally with regards to housing, labor force opportunities, health insurance, education, and income, resulting in a greater risk of adverse outcomes for discriminated groups (Lin et al., 2022). Individuals without health insurance coverage are largely unwilling to receive medical care and are more likely to experience more serious health conditions, with twice as many Hispanics and three times as many Blacks compared to Whites who are uninsured (Bovbjerg & Hadley, 2007).

Without exception, Blacks have a disproportionately high mortality rate from COVID-19, even after adjusting for demographic and socioeconomic characteristics (Garcia, 2021). In Alabama, infection and mortality rates are grossly disproportionate between Black and White patients (Gross, 2020). In Louisiana, Blacks account for 60% of deaths, even though they make up 33% of the state's population (Rogers et al., 2020). In Michigan, Blacks are disproportionately affected, with age- and population-adjusted mortality rates more than 3.6 times greater than mortality rates among whites (Parpia, 2021). In Chicago, Blacks make up 30% of the population but account for nearly 70% of COVID-19 deaths (Alcendor, 2020). In 28 states, Blacks have, on average, a risk of death 3.57 times higher than that among Whites, Wisconsin and Kansas have the highest mortality rates for Blacks, nearly six times higher than that for Whites (Gross, 2020).

According to state mortality reports, Hispanics and Blacks have similarly high mortality rates, and in California, Hispanics lead the way (CDC, 2022). Compared to Blacks and Hispanics, Whites and Asians have much lower mortality rates. This may result from the higher vaccination rates and higher health insurance coverage and fewer chronic health conditions among Asians and Whites, respectively. (America's Health Rankings, 2022).

Conclusion

The impact of COVID-19 on human health, the economy, and the health care system has been substantial. Due to differences in underlying population distributions across states, it is imperative to fully understand the impact of the COVID-19 pandemic on ages of death, racial/ethnic and education groups, especially in

Riverside County, California, a racially diverse region. Moreover, making improvements and adjustments to the existing medical policies to address these differences and design new prevention plans for high-risk groups will help reduce the infection rate and mortality of COVID-19.

Purpose of the Study

The purpose of this study was to explore and examine if there is a relationship between age of death, race/ethnicity, education, in Riverside County, California. The results from this study will be used to help public health develop more tailored prevention programs and mitigation measures to reduce COVID-19 mortality and prolong life.

Research Questions

1. Is there an association between age at death and race/ethnicity?
2. To what degree does race/ethnicity and education level predict the age at death?

Hypotheses

1. Whites have older age of death compared with other racial/ethnic groups.
2. Whites and college degree have older age of death compared with other race/ethnicities and those without a college education.

Method

Design

This study used a cross sectional design to examine the relationship between the age of death, education, and race/ethnicity in Riverside County, California. Mortality data from Riverside University Health System - Public Health's (RUHS-PH) Death Statistical Masterfile will be used. This study has been deemed a non-human subject study by the California Baptist University (CBU) Institutional Review Board (IRB) on April 22, 2022, due to the use of secondary data (see Appendix A).

Procedures

The data used in this study were obtained from the RUHS-PH using a dataset that included all deaths caused by COVID-19 among Riverside County, California residents from March 2020 to December 2021. The data collected included basic demographic information, including age, race, gender, occupation, and education. In addition to basic information, the data source includes vaccination status, and leading causes of death. The data source analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.

Participants

Study participants were decedents due to COVID-19 from the March 2020 to December 2021. There were 5,105 deaths during the selected time frame. Using G*Power Software, Version 3.1.9.7, for the first question, the calculation was computed with beta(β)=.80, alpha(α)=.05, effect size (ρ)=.1. The minimum required sample size was estimated at 1,372 to perform the One-way ANOVA analysis. For the second question, the calculation was computed with beta(β)=.80, alpha(α)=.05,

effect size (ρ)=.15, The minimum required sample size was estimated at 109 to perform the multiple regression analysis. Based on the sample size, the analysis of the first and second research questions was well supported.

Independent Variable and Dependent Variable

For the first question: "*Is there an association between age at death and race/ethnicity?*", the independent variable is race, consisting of eight nominal categories: White, Black, Asian, American Indian/Alaskan Native, Hawaiian/Pacific Islander, Others, Hispanic, and Two or More Races. The dependent variable is the age of death, and RUHS-PH records the exact age of participants at the time of death due to COVID-19 as a continuous variable.

For the second research question: "*To what degree does race/ethnicity and education level predict the age at death*", the independent variable are race/ethnicity and education level. For race/ethnicity, there were eight nominal categories recorded as:1= White, 2= Black, 3= American Indian/Alaskan Native,4= Asian,5= Hawaiian/Pacific Islander,6= Other, 7= Two or More Races, and 8= Hispanic. For education level, there were six nominal categories recorded as :1= Less than High School, 2= High School/GED, 3= Professional/Trades, 4= Some College,5= College Degree, 6= Postgraduate. The above six categories were then collapsed into two categories, College Degree and No College Degree. The categories of College Degree and Postgraduate were record as 1=College Degree. The categories of Less than High school, High School/GED, Professional/Trades, and Some College were recorded as 2=No College Degree.

Data Analysis

For the first question: "*Is there a relationship between age of death from COVID-19 and race/ethnicity?*", a one-way ANOVA was used to determine whether there was a relationship between race/ethnicity and age at death. To answer the second research question, "*To what degree does race/ethnicity and education level predict the age at death?*", a multiple regression was used.

Results

Participant Demographics

This study examined the influence of death of age, race/ethnicity, and education level on COVID-19 mortality. It was hypothesized there was a strong relationship between the race/ethnicity and age at death. Additionally, it was hypothesized that race/ethnicity and education were the strong predictor of age at death. One-way ANOVA, multiple regression, and descriptive statistics were used to test the hypotheses and examine the data. Table 1 and Table 2 shows the demographics characteristics of the study participants from March 2020 through December 2021.

Major Findings

There were 5,105 deaths during the study period. The median age for all deaths was 69.8 years, with most deaths (65.7%) occurring among those 65 and older. Among all races, Hispanics had the highest number of deaths (49.5%) and those that identified as other race had the lowest number of deaths (.2%). Among all education levels, the largest number of deaths occurred among those with a High school/GED (33.7%), while those who attended Professional/Trade school had the lowest number of deaths (.8%) (See Table 1). Additionally, a greater proportion of Whites had a college degree (55.8%); however, a great percentage of Hispanics (56.2%) had no-college degree (See Table 2).

For the first question: "*Is there an association between age at death and race/ethnicity?*", a one-way ANOVA was performed. Age at death differed significantly between the eight racial/ethnic groups, F (8, 5096) =68.45, P<.001. Age at death were oldest among Whites had the oldest age at death (M=75.64, SD=13.07),

while American Indian/Alaskan Natives had the earlier age at death (*M*=61.41, *SD*=16.38).

Since there was significant difference within race/ethnicity groups, with post hoc tests showing that Whites (*M*=75.64, *SD*=13.07), had a significantly higher age at death compared to all races except Other *(M*=67.22, *SD*=17.10, *P*=1.00 >. 05). Asians (*M* =71.98, *SD*=14.04), had a significantly difference compared to all races except other race (*M*=67.22, *SD*=17.10, *P*=1.00 >. 05) and Hawaiian/Pacific Islander (*M*=66.04, *SD*=14.89, *P*=1.00 >. 05). There was no significant difference found among the other race/ethnicity groups (See Table 3).

For the second research question: "*To what degree does race/ethnicity and education level predict the age at death*", a multiple regression was performed. The results of the regression indicated that the model explained 9.7% of the variance, and race/ethnicity and education level were found to predict age at death (R^2 =.097, *P*<.001).

Race was the strongest predictor of age at death compared to education. More specifically, compared with all independent variables, Hispanics had the largest absolute value of β, so Hispanics had the largest effect on age at death, which explained the greatest degree of variation in age at death. More specifically, age at death was significantly different for Hispanics (β= -.33, B=-9.70, *P*<.001) with death occurring on average nearly ten years earlier than that of Whites. Additionally, age at death was lower among Asians (β= -.05, B=-3.65, *P*<.001), American Indian/Alaskan Natives (β=-.07, B= -14.28 , *P*<.001), Two or more races (β=-.08,B= -10.45, *P*<.001), Blacks (β=-.14, B= -8.65, *P*<.001) and Hawaiian/Pacific Islanders (β=-.04, B= -9.59,

P=.001), with respect to Whites (see Table 4). Age at death was not statistically different for those without college degree (β=-.003, B=-.10, *P*=.85 > .05) compared to those with a college degree (see Table 4).

Discussion

Summary of Major Findings

The purpose of this study was to examine the relationship between age of death, race/ethnicity, and education, in Riverside County, California. Further, this study explored predictors of age of death.

Race/Ethnicity and Age of Death

For the first question, it was hypothesized that Whites have older age of death compared with other racial/ethnic groups. The result of this study showed a significant relationship between racial/ethnicity and age of death. More specifically, mean age at death were highest among Whites compare to other race/ethnicity groups. This finding aligns with current literature which indicates that during the COVID-19 pandemic, Whites tend to live longer than other racial/ethnic groups (Andrasfay & Goldman, 2021; Feldman & Bassett, 2021; Rogers et al., 2020). This finding may be explained by the fact that Whites have higher homeownership, broader health insurance coverage, higher education, and income than other groups which prepare equip them to face the COVID-19 pandemic and its impacts (Lin et al., 2022). In addition, this study also found that American Indian/Alaskan Natives had the earliest age at death. This finding contradicts current literature, which indicates that Hispanics and Blacks are prone to premature death due to their low socioeconomic status (Andrasfay & Goldman, 2021; Woolf & Aron, 2021). This difference may be because American Indian/Alaska Natives have higher mortality from chronic diseases compared to Blacks and Hispanics, which results in a shorter life expectancy (Arias et al., 2021). In addition, chronic diseases have been proven to

be risk factors for premature death during the COVID-19 pandemic. (Tskhay & Alibek, 2020).

Race/Ethnicity, Education and Age of Death

For the second question, it was hypothesized that race/ethnicity and education would each be strong predictors of age at death. More specifically, Whites and those with a college degree have an older age of death compared with other race/ethnicities and those without a college education. Compared with all independent variables, the analysis found Hispanics had the largest effect on age at death (β= -.33, B=-9.70, p<.001), followed by Blacks (β=-.14, B= -8.65, p<.001). These findings may be explained by the fact that, repeatedly throughout the pandemic, there has been the acknowledgment of persistent social and economic inequalities, with Hispanics and Blacks bearing the brunt, especially in the face of poverty and overcrowded housing, low-income jobs, extremely high levels of chronic health conditions, and lack of access to quality healthcare (Goldman et al., 2021). Overcrowded housing, which prevents maintaining safe distances, increases the risk of spreading COVID-19, thus increasing susceptibility to COVID-19 (Goldman et al., 2021). Furthermore, lower incomes prevent the preparation to equip them to face the COVID-19 pandemic and its impacts (Lin et al., 2022); and reduce access to quality health care, leading to an increased risk of death from COVID-19 (Garcia et al., 2021).

Compared with all independent variables, the study also found Asians had the lowest effect on age at death (β=-.05, B= -3.65, P<.001). These findings may be explained by the fact that, Asians have fewer housing problems, higher education levels, and greater willingness to spend on healthcare (Andrasfay & Goldman, 2021).

And among all ethnic groups, Asians have the lowest prevalence and incidence of chronic diseases, which buffers against COVID-19 risk and supports longer life expectancy (America's Health Rankings, 2022).

When examining education, this study found that age at death was not statistically different between those with and without degrees (β=-.003, B=-.10, p=.85 > .05) and college degrees. This finding contradicts current literature, which indicates that education attainment is a predictor of COVID-19, and low education levels are associated with a higher risk of COVID-19 (Jian et al., 2021). Furthermore, according to Case & Deaton's report (2021), education has an indirect effect on mortality from COVID-19. People with higher education levels are more willing to receive vaccines and have a better risk of COVID-19 cognition and awareness of prevention (Case & Deaton, 2021).

Public Health Implications

There are two public health implications that are relevant to this research. The first one is this study suggest that preventive approaches to reduce mortality and prolong life from COVID-19 should focus on the root cause of racial/ethnic disparities, especially among Hispanics and Blacks, which are critical for designing and implementing relevant policies and improving well-being to compensate for their lower socioeconomic status (Garcia et al, 2021)

It is well known that the United States has been plagued by systemic racism that has limited access to socioeconomic opportunities and health care for many people of color, with serious adverse health consequences. (Feagin & Bennefield, 2014). However, the COVID-19 pandemic has once again magnified this problem. Racial

inequalities persist, especially among Hispanics and Blacks, and social and economic disadvantage makes them more vulnerable to COVID-19 due to lack of employment opportunities, overcrowded housing, and poor insurance coverage (Lee et al., 2020). Therefore, reducing or even eliminating racial inequality and addressing racism in public health is crucial (Rogers et al., 2020).

Another public health implication is that higher vaccine hesitancy rates and lower vaccination rates due to racial/ethnic disparities have contributed to premature deaths among Blacks and Hispanics during the COVID-19 pandemic (Dror et al., 2020). The main reasons for this are that Blacks and Hispanics generally have lower education levels than other groups, do not have enough knowledge about COVID-19 and the COVID-19 vaccine, and express concerns about the quality and side effects of vaccines (Malik et al., 2020). In addition, there are also substantial differences in the resources that can support vaccinations. This is especially an issue in Black communities, where vaccine supply is limited, the elderly is not used to online appointments, and the lack of sufficient vaccination sites has become a significant problem (Sallam, 2021). Therefore, there is an urgent need to carry out interventional education activities for people at risk of vaccine hesitancy to accurately deliver vaccine safety-related information in order to combat misinformation and avoid low vaccination rates. (Dror et al., 2020) Public health should also strengthen cooperation with community organizations and media organizations, and increase access to vaccination, thereby reducing racial disparities in vaccination (Momplaisir et al., 2021).

Study Limitations

The findings of this study are subject to some limitations. The first and the most obvious is the timeliness and completeness of the data collection. This limitation is consistent with previous research showing that death data lacks timeliness and completeness due to the secondary nature of the information (Flaxman et al, 2020). More specifically, the data collection time in this study was March 2020 to December 2021. It takes about two weeks for the death certificate information to be updated daily, and it generally takes 4-7 weeks to improve the accuracy (Menéndez et al., 2020). More people died during that time than were collected. In terms of completeness, identifying whether a patient died from COVID-19 is complicated, and the role of COVID-19 in death may not be clear unless an autopsy is performed (Menéndez et al., 2020). Furthermore, there was very little testing in the early days of the COVID-19 outbreak, and many infected people died without testing so that the early COVID-19 deaths may have been exaggerated (CDC, 2021).

In addition, this study was limited by the type of variables in the Death Statistical Masterfile. Current literature has explored the relationship between occupation and COVID deaths (Nafilyan et al., 2022). Specifically, workers who need to work face-to-face are most affected, especially healthcare workers, who are at greater risk of exposure to COVID-19 and are more susceptible to infection. (Mutambudzi et al., 2021). Compared with other occupations, food, transportation and manufacturing workers, the COVID-19 mortality rate is disproportionately high (Chen et al., 2021). However, in this study, the relationship between occupation and COVID deaths cannot be well explored due to the nature of the data collected, such as

rough classification or inaccurate reporting resulting in misclassification of occupations in death certificates.

Finally, in this study's prediction of the age of death from COVID-19, race/ ethnicity, and education had an effect of only 9.7%. In other words, only 9.7% of the age of death from COVID-19 is influenced by race/ethnicity and education. The influence of race/ ethnicity and education on COVID-19 deaths is small, and it is therefore not the strongest predictor of the age of death of COVID-19. Future studies should consider other factors such as occupation and COVID-19 vaccination status at death.

Conclusion

This study provides information on how the relationship between specific demographic factors and COVID-19-related deaths between March 2020 and December 2021. The results of this study suggest that during the pandemic, there are significant differences in age across race/ethnicities among those who have died from COVID-19.

Race/ethnicity was stronger predictor of age at death, with larger differences among Hispanics. While there was no significant relationship between education and age at death, which is inconsistent with most literature findings, more research should be conducted to understand better the extent of this possible relationship (Truman & Moonesinghe, 2022).

Despite some limitations of the study, these results can inform public health messaging and impact mitigation efforts focused on prevention and the early

detection of infections in disproportionately affected populations to in order to prolong life. (Andrasfay & Goldman, 2021).

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Table 1

Demographic Characteristics of Study Participants (n=5105)

Variable	n	%
Race/Ethnicity		
White	1891	37.0
Black	293	5.7
Hispanic	2527	49.5
Asian	254	5.0
American Indian/Alaska Native	29	.6
Hawaiian/Pacific Islander	24	.5
Other	9	.2
Two or More Races	69	1.4
Unknown	9	.2
Educational Level		
Less than high school	1503	29.4
High school/GED	1719	33.7
Professional/Trades	40	.8
Some College	792	15.5
College Degree	735	14.4
Postgraduate	195	3.8
Unknown	121	2.4
Age		
0-4	0	0
5-18	3	.06
19-49	489	9.6
50-64	1260	24.7
65+	3353	65.7
	69.85*	

*Mean Value Reported

Table 2

Description of Race/Ethnicity, College Degree, and Non-College Degree

	College Degree (n=930)		Non-College degree (n=4052)		Unknown (n=121)	
Variable	n	%	n	%	n	%
Race/Ethnicity						
White	519	55.8	1329	32.8	43	35.5
Black	77	8.3	208	5.1	8	6.6
Hispanic	198	21.3	2276	56.2	53	43.8
Asian	106	11.4	141	3.5	7	5.8
American Indian/Alaska Native	1	.1	27	.7	1	.8
Hawaiian/Pacific Islander	5	.5	18	.4	1	.8
Others	5	.5	4	.1	0	0
Two or More Races	19	2.0	49	1.2	5	4.1
Unknown	0	0	0	0	7	5.8

Table 3

Summary of One-Way ANOVA for Race/Ethnicity

Variable	Mean	SD	F (8, 5096)	η2
Race/Ethnicity			68.45	.097
White	75.64	13.07		
Black	66.97	14.48		
Hispanic	65.90	14.93		
Asian	71.98	14.04		
American Indian/Alaska Native	61.41	16.38		
Hawaiian/Pacific Islander	66.04	14.89		
Other	67.22	17.10		
Two or More Races	65.16	15.15		
Unknown	69.67	9.95		

Table 4

Summary of Multiple Regression Analysis for Variables Predicting Age at Death

Predictor	B	β	t	CI
Constant	75.68	0	156.21	(74.74, 76.63)
Education Level				
Non-College Degree	-.10	-.003	-.19	(-1.10, .91)
Race/Ethnicity				
Black	-8.65	-.14	-9.70	(-10.40, -6.90)
Hispanic	-9.70	-.33	-21.87	(-10.56, -8.83)
Asian	-3.65	-.05	-3.83	(-5.51, -1.78)
American Indian/Alaska Native	-14.18	-.07	-5.33	(-19.39, -8.96)
Hawaiian/Pacific Islander	-9.57	-.06	-4.28	(-15.29, -3.85)
Other	-8.42	-.02	-1.77	(-17.73, .89)
Two or More Races Hispanic	-10.45	-.08	-6.00	(-13.87, -7.04)

Note. R^2=.097, *P*<.001. Whites and college degree serve as the reference categories.

Appendix A: IRB Approval

RE: IRB Review
Designation: Not IRB Human Subjects Research
IRB NO.: 098-2122-NHSR

Project: Examine the Relationship Between COVID-19 Mortality Rate, Cause of Death, Age, and Race in Riverside County, California

Date Complete Checklist/Application Received: 4/22

Principle Investigator: Hongyu Shi
Faculty Advisor: Marshare Penny

College/School: College of Health Science

IRB Determination: Not research with human participants (including quality improvement projects) – IRB review has determined that this project does not meet the federal guidelines for research with human participants (definitions available in the IRB handbook), and is thus not regulated by the IRB. We will retain a copy of your submission and this determination letter.

Future correspondence: If you have any questions about this determination, please refer all queries to irb@calbaptist.edu, being sure to include all PIs, Co-PIs, and Faculty Advisors (as relevant) as asll as the assigned IRB number.

Date: April 26, 2022