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Racial Bias in the Medical Field and Its Influence on BIPOC Teenagers & Young Adults' Decisions to Get Vaccinated for COVID-19

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Abstract

Racial discrimination prevailing in our society is reflected in the healthcare industry. To study how these racial disparities affect an individual's decision to get the COVID-19 vaccine, a survey was sent out to research how BIPOC teenagers and young adults are influenced by specific factors. The google form survey included questions asking respondents whether a specific factor influenced their decision to get the vaccine as well as asking their opinions on possible solutions for racial discrimination in healthcare. The data indicated that 88.1%, 86.7%, 90.2%, and 78.3% of the White, Black or African American, Asian, and Hispanic or Latino population, respectively, will be receiving or have already received the COVD-19 vaccine. It was observed that 87.4% of the participants responded that they will receive the COVID-19 vaccine where 77.2% of them believe there is racial bias in medicine but 85.6% of them did not experience racial bias. Linear regression was used to analyze the data to discover whether the responses to a specific question would impact whether they will get the COVID-19 vaccine. The linear regression analysis found that the most of data correlations were not significant where the p values were mostly greater than 0.05, with the exception of one, which is the correlation between receiving the COVID-19 vaccine and whether they think there is racial bias in medicine. Regardless, weak correlations where the R values were all close to 0 were found in the analysis of the data and therefore, the study did not produce any conclusive results. Limitations of this study include a small sample size where the primary responses came from the Asian population when the research was conducted to study the effects of racial bias on the BIPOC population.

Categories: Medicine, COVID-19, Adolescents
Key Words: COVID-19, Racial Bias, Medicine, Vaccination, Young Adults, Teenagers

Introduction

Race-based discrimination and disparaties are prevalent in the healthcare industry and is reflected in the quality of and access to healthcare, as well as in society in general. Indeed, racial stereotypes and general racial discrimination has often led to differential care and treatment for BIPOC (black, indigenous, people of color). This may also stem from the lack of efforts in placing resources and establishing programs in communities and neighborhoods that have a denser POC population. These communities may sometimes not be prioritized when funding comes into play, which would result in the scarcity of medical resources and centers. Even if there were resources made publicly available, people also play a vital role in race-based discrimination. Many healthcare workers are inherently and racially biased, which leads to misdiagnosis and therefore mistreatment of diseases BIPOC population could face. Some research has shown that healthcare worker attitudes differed when it came to Whites and non-Whites (Hall et al., 2015). Due to this inherent racism, many BIPOC have learned to be doubtful of modern medicine. There has been a history of events and occurrences in which BIPOC, and specifically the Black community, were experimented on, and essentially treated as lab rats for scientific discoveries and research (Ferdinand et al., 2020). In the name of science, medical researchers and scientists had sometimes hidden the agendas for the experiments, thus leaving the BIPOC subjects clueless and ignorant of what has happened to them.

In contemporary society, specific instances of medical racism are often brought to light in modern media, further informing youth of these prevalent issues and potentially inspiring new fear of healthcare. Some of this fear may have been rooted from knowledge of events such as the Tuskegee experiment on African Americans, and instances such as the HeLa cell controversy (Ferdinand et al., 2020). In both cases, informed consent had not been considered, leaving those affected to be blind from the truth. This could affect whether black communities decide to get vaccinated for COVID-19, specifically the teenage population who are young and are have more access to media coverage on discrimination and racism. The teenage population would more drastically show the effects of the impacts of systemic racism since they are still developing and growing, so systemic racism can negatively influence their growth, mental and physical health. Already, it seems like racism has affected other sectors in society pertaining to education, housing, and policing. With instances such as the murder of George Floyd (Bryant, 2020), whose murder by the hands of a policeman was recorded and broadcasted worldwide, it has sparked countless movements to uplift and represent the Black community, some of which are led by students or has had students participate in the protest to spread awareness of such systemic racism. This also occurred during the time of the COVID-19 pandemic.

While most data present and available are of the general public, there are little to no studies conducted that investigate the hesitancy of students on the COVID-19 vaccines. One research that has been completed investigated vaccine hesitancy among university students in Italy, in which a majority of the sample had a desire to be vaccinated (Barello et al., 2020). However, this study does not incorporate the factor of race or race-based discrimination in healthcare in their study, nor had the researchers include any respondents from the U.S. Another study conducted has examined the willingness of medical students to receive the vaccines, as they are a vital component in the battle against COVID-19 (Lucia et al., 2020). Their research, however, also did

not focus on the element of race or ethnicity, though had a focus more on education. As such, very limited data on race and COVID-19 vaccination are made publicly available.

Currently, the U.S has offered three different brands of vaccines to protect against COVID-19, namely the Pfizer vaccine, the Moderna vaccine, and the Johnson and Johnson vaccine. It is worth noting that the Johnson and Johnson vaccine requires one dose, whereas the Pfizer and Moderna vaccines both require two doses. Different states in the U.S have been also expanding the vaccine eligibility at different stages, with New York state currently allowing anyone above the ages of 16 to receive the vaccine. This encompasses most of the students in college and some of the students in high school. It is eminent to mention that Johnson and Johnson have begun pausing the distribution and vaccination of their vaccines as of April 13, 2021, as there have been 6 rare instances that have led to severe blood clots as a complication and side effect of receiving their vaccine. Currently, only Moderna and Pfizer vaccines are being distributed and utilized amongst the U.S states, while some other countries have been offering AstraZeneca and other brands of vaccines. As more and more people are getting vaccinated, more and more appointments are now becoming available in healthcare centers and pharmacies. This is where technical dilemmas and the side effects of the vaccine come into play. With much of society operating remotely and virtually, scheduling for an appointment often requires internet connection, knowledge of surfing the web, and also knowing which centers offer them. This becomes a complicated process for the older generation, who might not have as much technical expertise when it comes to using electronic devices and the internet. The root cause is education, and specifically the education of the BIPOC community on technology. The lack of education and educational programs may be tied to racial problems, and lack of effort in setting up more educational centers and resources in BIPOC neighborhoods.

Due to the current severity of the virus, the research conducted in this experiment aimed to gauge just how much systemic racism affects the medical decisions of today's BIPOC youth. To evaluate the relationship between ethnicity/race and a student's decision on getting the COVID-19 vaccine, an anonymous survey was distributed amongst high school and college students throughout the U.S using a convenience sampling methodology. Questions regarding the student's demographics, vaccination history for the Influenza virus, and whether they believe there is a presence of racial bias within the medical and healthcare industry, were asked in the survey. The collected data were analyzed quantitatively through multivariable linear regression models as well as qualitatively through analysis of respondents' rationale regarding their decision of whether or not they plan on getting the COVID-19 vaccine or if they have already gotten the vaccine.

Literature Review

Access to Healthcare
Various research studies suggest that minority groups including Blacks, Asians, and Hispanics "have lower levels of access to medical care" compared to their white counterparts in the U.S. (Blendon et al., 1989; Brown et al., 2000; Williams and Rucker, 2000). Possible reasons for this disparity in access to health care include the racial disparities in income, employment, and wealth.

According to a research study published in 2003 analyzing data from "1996-1997 and 1998-1999," factors like income, insurance coverage, and accessibility of safety net services contributed to over "80 percent of the difference" between Hispanics and Whites in terms of access to healthcare. For African Americans, different rates of insurance coverage was the primary contributor to the disparity in access to healthcare between the two groups. However, around 50% of the difference between African Americans and White Americans in access to healthcare was left unexplained, but the study suggests that this unexplained difference could possibly be due to racial discrimination in healthcare workers, mistrust, and miscommunication (Yearby, 2018). Racial disparities can lead to disparities in socioeconomic statuses, which can then lead to a lack of access to healthcare. These differences in socioeconomic statuses can arise from residential racial segregation, which has placed a disproportionate amount "of African Americans in" areas with poorer "housing conditions (and reduced) educational and unemployment opportunities," leading to reduced mobility in socioeconomic class (Williams, 1997).

However, although differences in socioeconomic status can be a potential factor in racial disparities in access to healthcare, a couple of research papers suggest that regardless of income level, these disparities are still present (LaVeist, 2005; Smedley et al., 2003; Williams, 1996; Williams et al., 2016). Specifically, a 2002 research paper suggests that although economic access does contribute to disparities in access to physician care, it doesn't contribute to the "ethnic/racial disparities in seeking physician care" (Dunlop et al., 2002). These research papers suggest that socioeconomic status and race are two different factors that both contribute to disparities in access to healthcare independently with no significant relationship between the two and access to healthcare. A research paper published in 2005 suggests that socioeconomic class plays a factor in health status, which contributes to blacks having reduced health status compared to their white counterparts. However, class isn't the only contributor to this disparity - education levels can also contribute to this, particularly with infant mortality due to low birthweight (Kawachi et al., 2005). Politics can additionally contribute to disparities in healthcare through the implementation of legislation that contributes to systemic racial inequalities. Examples include "political influence in decision-making" for hospitals and public clinics' funding levels, locations, and closings as well as the number of hospitals built in an area, which a lack of can contribute to overburdening (Smith, 2005; Williams, 1997).

This disparity in access to healthcare takes root in access to health insurance, mental health care, kidney transplant, long-term care, neurological health care, dialysis facilities, cardiac rehabilitation, primary care, physician care, "simultaneous pancreas-kidney transplantation," and "left ventricular assist device therapy" among others (Cook et al., 2016; Isaacs et al., 2008; Joyce et al., 2009; Kulkarni et al., 2019; Lurie, 2007; Mahmoudi & Jensen, 2012; Patricia et al., 2006; Saadi et al., 2017; Saunders et al., 2014; Shi et al., 2014; Smith et al., 2008).

Patients' Preference for Physician Race
Racial discrimination can factor into a patient's preferences for certain races for their healthcare providers, including physicians. One 2005 study found a link between the strength of "beliefs about racial discrimination in health care" and a preference for a same-raced physician among

African Americans and Latinos. For African Americans, although "only 22% of [them] preferred" a race concordant relationship with their health care provider, including, but not limited to, physicians compared to 78% of them having no preference or preferring a race discordant relationship, among the 22%, those who "had an African American physician were more likely to rate their physician as excellent than" those who didn't have one at a rate of 57% vs. 20%. Similarly, this applies to Latinos and their preference for Latino physicians (34% preferred one). However, there is no statistically significant data that suggests that a preference for "a Latino physician" increases levels of satisfaction among Latinos who had one. African Americans also perceived "racial discrimination in health care" more strongly than did Latinos. For white Americans, around 75% of them "had no [racial] preference" for their physicians, but among those who did prefer a same raced physician and had one, there were higher levels of satisfaction with their physician than did those who had a preference for "a white physicians but had a nonwhite physician" at a rate of 71% to 29%. Chen et al. (2005) suggests that this difference in satisfaction could be due to less trust "in race-discordant relationships" among "patients with strong racial preferences" (Chen et al., 2005). A similar finding was reported in another research paper that found that minority patients' perception of the quality of their "interactions with their physicians" is lower than that perceived by White patients (Cooper-Patrick et al., 1999). This correlation is supported by various other research papers including in other minority groups like Hispanics and Asians (Cooper et al., 2003; Doescher et al., 2000; Saha et al., 1999; Saha et al., 2011). However, this preference for a same race physician/ healthcare provider could be due to sociocultural reasons as well as for communication reasons rather than racial discrimination reasons (Saha et al., 2000).

Racial Discrimination in Healthcare

As aforementioned, race negatively impacts how BIPOC are treated by healthcare workers due to their inherent biases. Many of the speculated reasons for the health disparity among racial/ethnic groups include the gap in socioeconomic status, the difference in access to care, the quality of care, and health outcomes. In summary, racial discrimination is a prevelant issue in the healthcare system. In a review analyzing implicit racial/ ethnic bias in healthcare and the influence on healthcare outcomes, it was found that the majority of health care providers seem to have implicit bias as they had positive attitudes towards Whites and negative attitudes towards non-White individuals (Hall et al., 2015). Moreover, research studies have pointed to a relationship between perceived discrimination and adversity in health outcomes. There has been proven associations with racial discrimination with reduced use of cancer screening, increased risk of hypertension, increased depressive symptoms, and more (Mouton, et al., 2013; Roberts et al., 2017; Lambert et al., 2009).

Furthermore, recent studies have pointed to racial bias in an algorithm that is widely used in US hospitals. This is a major issue as algorithms are something that health systems heavily rely on, given that they are used to identify and help patients with complex health needs. The study found that the algorithm was less likely to refer Black individuals than White individuals who were equally sick to programs intended to help patients with complex medical needs. When taking a close look at the data, it was revealed that the average Black person was provided with $1,800

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less care than a white person with the same health issues, raising questions about the systemic racism in the healthcare system (Obermeyer et al., 2019). This alludes to another issue in the healthcare system: racial bias in pain assessment and treatment recommendations. In 2016, a study found that 73% of white medical students held at least one false belief regarding the biological differences between different racial or ethnic groups. Some of these beliefs include the idea that Black people have a higher pain tolerance than white people because they have thicker skin, less sensitive nerve endings, or stronger immune system. These beliefs are centuries old, and have a deeply rooted history of racism, given that in the 19th century some doctors used these ideas to justify the inhumane treatment of slaves (Hoffman et al., 2016). Taken together, these studies have important implications for understanding race-related biases and healthcare disparities.

Misdiagnosis/Race Playing a Factor in Side Effects and Symptoms
Racial discrimination in healthcare often leads to poorer treatment in "patient centerdness, contextual knowledge of the patient, and patient-provider communication" (Hall et al., 2015). Consequently, patients of color often face misdiagnosis, resulting in improper treatment. Mistreatment also leads to worsened symptoms and side effects, as shown in a study done in 2012 which revealed that pediatricians were more likely to recommend an ideal pain management strategy to vignettes of white patients versus black patients (Sabin and Greenwald, 2012). This means that POC are more likely to suffer worse symptoms than their white counterparts for the same disease. This type of bias could be the result of a lack of POC healthcare workers, as a 2019 American community survey showed that whilst 60% of healthcare workers were white, only 16% were black and 13% were hispanic (Painter et al., 2021). The disparity in race within the field of healthcare could contribute to the inherent racism within workers, continuing the cycle of unequal treatment.

Racial Divide in the Healthcare Field
Besides biased diagnoses and treatment, racial division continues into the accessibility of healthcare resources. Because of the "system of racism" that has been created in America, it is harder for POC to attain the same quality of life and health as their white counterparts. This is shown in the American nursing home system- a national study performed in 2015-2016 showed that 75% of residents were white (Painter et al., 2021). To further this point, in 1972, a study named The Abecedarian project was performed to determine the effect of early childhood intervention on black children. The program provided access to pediatric care, nutrition, and a safe, nurturing environment. By their mid-30's, participants from the study were found to have lower rates of depression, as well as lower levels of risk factors for a multitude of different cardiovascular and metabolic diseases (Williams & Cooper, 2019). This study demonstrated that those with proper access to healthcare and a nurturing environment grow up both physically and mentally healthier. However, by that standard, POC are at a disadvantage. A survey performed in 2014 showed that hispanic and black nonelderly adults (aged 19-64) had the highest rates of uninsurance, with 33.4% of hispanic and 20.7% of black participants being uninsured. Additionally, when looking at rates of insurance, white participants had the highest rates of

private insurance, at 74.3% (Buchmueller et al., 2016). As such, white, insured citizens in America hold an advantage over all.

Impact of Racial Discrimination on the Mistrust of Healthcare System

The inherent racism in medicine has been an ongoing issue. Unequal treatments and mistrust in our healthcare system has historical roots, reaching as far as the 19th century (Wells and Gowda, 2020). Some have theorized that the mistrust in medicine and healthcare have risen due to the historical maltreatment of African Americans in the US healthcare system (Wells and Gowda, 2020). Within African American communities in the South during the 19th century, approximately 90% of Blacks were in slavery, and were sold into medical experimentation as they were no longer needed in the fields (Wells and Gowda, 2020). No rights were in place during this time that protected Blacks from being experimented, nor were they given informed consent (Wells and Gowda, 2020). People rationalized that Blacks were inhumane and thus, was their logic as to why African Americans should be experimented on (Wells and Gowda, 2020). Wells and Gowda described that African Americans related western medicine to punishment where there was a loss of control over their bodily functions (2020).

Following, there are other cases that demonstrated the maltreatment of POC groups in medicine. For one, the reluctance of African American to receive vaccinations may be attributed to the lingering and traumatic effects of the Tuskegee Syphilis Experiments (Ferdinand et al., 2020). The study lasted for 40 years, and consisted of 600 African Americans, some which had syphilis. The purpose of the experiment was to observe the progression of untreated syphilis in African American males, yet they were poked, prodded, and subjected to x-rays, spinal taps, and treatments that they've received. Towards the end, penicillin was scientifically proven to be effective against the syphilis, yet was not administered to a majority of these African American males in order to continue the experiment (Wells and Gowda, 2020).

Lack of POC Receiving the Vaccine

As such, the mistrust in medicine is reflected by the statistics on COVID-19 vaccine uptake. Only 39.6% of racial and minority groups have received the vaccine as compared to the other 60.4% (Painter et al., 2021). General statistics have also shown that women and non-Hispanic Whites were vaccinated more compared to other groups (Painter et al., 2021). Ferdinand et al. talks about the importance of vaccination, as "suboptimal influenza immunization acceptance exacerbates flu-related adverse health outcomes, similar to difficulties from the effects of the COVID-19 pandemic" (2020). Additionally, Blacks, AI/AN, and Hispanics were reported to have more severe reactions and symptoms to COVID-19 (Painter et al., 2021). This may be attributed to preexisting morbidities within these populations, and may be a result of the lack of quality treatments and socioeconomic factors. As such, a 2009 study in Pittsburgh, Pennsylvania has shown that Blacks were twice as likely to distrust medical research compared to Whites (Wells and Gowda, 2020). Recent data show that "Black Americans are dying of COVID-19 infection at disproportionately high rates. In Milwaukee County, for example, nearly three quarters of COVID deaths were black, with blacks representing only about a quarter of the county's population. Additional data from New Orleans, Detroit, Chicago and New York show similar racial

imbalances" (Wells and Gowda, 2020). It becomes evident with studies like this that reveal the eminent need for new programs and practices to better serve and attend Black patients and the Black community.

Interventions to Address Disparities and Discrimination in the Healthcare System
Discrimination has led to the unequal opportunities in terms of social and economic resources especially due to a system that favors the success of one racial group over another group (Pager and Shepherd, 2008). A consequence of racial discrimination could be in terms of the quality of healthcare. Healthcare disparities pertaining to race and ethnicity are defined as the differences in healthcare quality provided to patients of color and white people' (Griffith et al., 2007). Throughout its history, the healthcare system in the United States has not provided equal care (Griffith et al., 2007). According to Byrd and Clayton (2000) and Krieger (1987), "African Americans [specifically] have had the worst health care, the worst health status, and the worst health outcomes of any racial or ethnic group" (Griffith et al., 2007).
Common approaches to addressing these disparities have been through individual educational sessions and training to increase knowledge of different cultures (Griffith et al., 2007). However, as common as these approaches are, they have been shown to have limited effectiveness, especially if they are not coupled with policies and change efforts organization-wide (Griffith et al., 2007). There have been implementation of programs and training over the years as an effort to address these racism and inequities in the healthcare system. The Southern County Public Health Department had implemented a dismantling racism training along with an optional section to address institutional racism (Havens et al., 2011). In healthcare, dismantling racism refers to the systematic intervention to address racial inequities and disparities, which can include policy and organizational changes, reeducation, or community organizing (Griffith et al., 2007). Some possible strategies include increasing regulatory vigilance and initiatives to train medical professionals of minority groups (Williams and Ruckere, 2000). In 2004, the Sullivan Commission suggested that the essential starting point for understanding the disparities in the healthcare system is for people to recognize the presence of race-based inequities and identify how racism operates (Griffith et al., 2007). Another approach to addressing the inequities is anti-racist community organizing, which is "an intervention strategy that builds on the core components and principles of community organizing and infuses anti-racism as a core value" (Griffith et al., 2007). Thus, to effectively address the disparities in healthcare quality, it is important to identify and implement strategies that can eliminate the racial inequalities and this should be made a national priority (Williams and Ruckere, 2000).
Connecting these disparities in the healthcare system and the current COVID-19 pandemic and vaccination process, how does these racial disparities affect how teenagers' decisions in getting vaccinated? Perhaps BIPOC teenagers and young adults will be more likely to fear the vaccine due to racial bias in the medical field. Studies in the past, such as the Tuskegee Syphilis experiment, have put BIPOC, specifically Black Americans, in a position where they were poked and prodded, for the sake of investigating the natural progression of untreated syphilis. With a new disease and epidemic, it is possible that occurrences such as the Tuskegee experiment will influence the desire of BIPOC teenagers and adults to receive the vaccines.

Methodology

Research Question

This research study aims to determine the correlation between an American adolescent's views regarding racial discrimination and bias in the medical and healthcare industries and his/her/their decision to get the COVID-19 vaccine. The research also aimed to see if adolescents thought that racial bias exists in medicine and healthcare, and if so, what they thought would be the best solution to address this.

Data Collection & Sampling Method

Convenience sampling was used for the purpose of data collection. A survey made on google forms was sent out to high school and undergraduate students, specifically American teenagers and young adults between the ages of 13 and 22. The survey was posted on various social media platforms as well as emailed out to guidance counselors from various schools in order to ask them to distribute it to their students.

The survey was divided into four sections, general participant information, vaccinations, racial bias in the medical field, and racial bias' impact on decision to get vaccinated. In the first section, general information about the participants was collected, including their name or nickname, age, location (US), and ethnicity/race. In the second section on vaccination, respondents were asked about their decision on getting vaccinated for COVID-19 when eligible, whether they received the flu vaccine in previous years, whether or not they plan on or are currenting doing in-person or hybrid school/classes. In the third section on racial bias, respondents were asked about their opinions on racial bias in the medical field, whether they have experienced racial bias in the medical field, and their preference for a same race physician. Here, they were also asked to identify specific examples of racial bias they have experienced and witnessed according to the options that were thought of based on the literature review and if possible, suggest their own. In the fourth section on the impact of racial bias, respondents were asked whether racial bias affected their COVID-19 vaccination decision and provide possible solutions to racial bias. Data collection took place over the span of 3 weeks.

Data Analysis

Data was analyzed through multivariable linear regression. The correlation between the respondents' response about their decision on whether or not they plan on getting vaccinated for COVID-19 when eligible and factors that may influence those responses including were compared.These factors were the respondent's response to the questions of whether they have received the flu vaccine in the past, whether or not they plan on returning to are currently doing in-person school, and whether they think there is racial bias in the medical field, and whether they have experienced racial bias.

The correlation coefficients will be calculated in order to determine the strengths of the relationships. A breakdown of the data in terms of percentages will be put into a chart in order to better analyze it. For the sections regarding instances of racial discrimination experienced,

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instances of racial discrimination witnessed, and possible solutions that can address racial biases in medicine and healthcare, responses will be analyzed both quantitatively (pre-written choices provided) and qualitatively (respondent's own responses).

Ethical Considerations & Possible Risks
Ethical concerns for this study included anonymity, informed consent, confidentiality, privacy, and comfort. These concerns were addressed by making the google form responses anonymous so no identification information other than their name was collected. There was also an added option to leave a nickname if they felt uncomfortable. The data collected was kept strictly confidential, and it was only used for research purposes. A brief synopsis of the research study was provided at the start of the survey in order to have an informed consent for the participation. And if the respondents felt uncomfortable at any point of the survey, they were free to stop whenever they wanted.

Results
Data
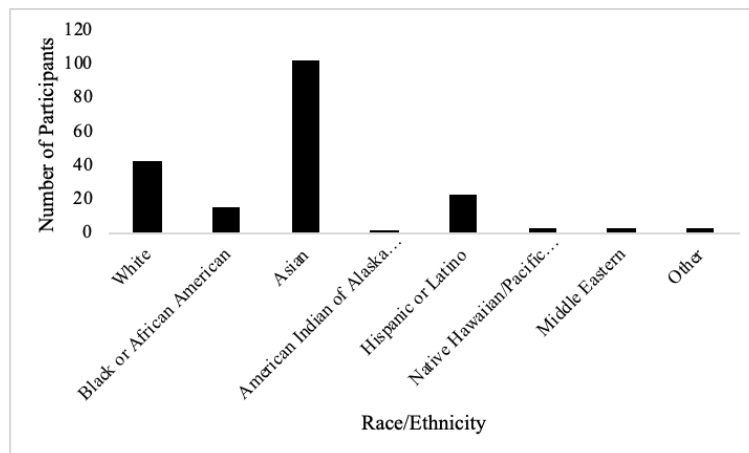
Figure 1. Race/Ethnicity of Participants

Our participants pool consisted of 42 White respondents (25.1%), 15 Black or African American respondents (9%), 102 Asian respondents (61.1%), 1 American Indian or Alaskan Native respondents (0.6%), 23 Hispanic or Latino respondents (13.8%), 3 Native Hawaiian/ Pacific Islander respondents (1.8%), 3 Middle Eastern respondents (1.8%), and 2 Guyanese respondents (1.2%). *****Percentages may add up to over 100 due to multiracial respondents****
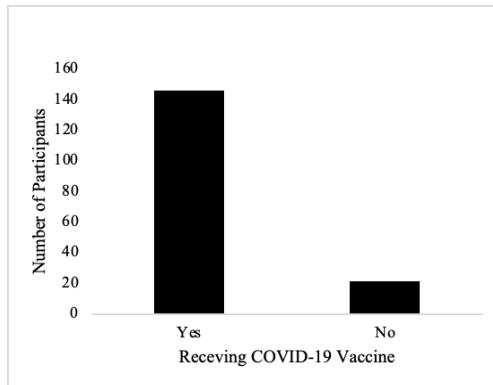
Figure 2. Whether participants will be receiving COVID-19 vaccine. 146 respondents (87.4%) replied yes, and 21 respondents (12.6%) replied no.
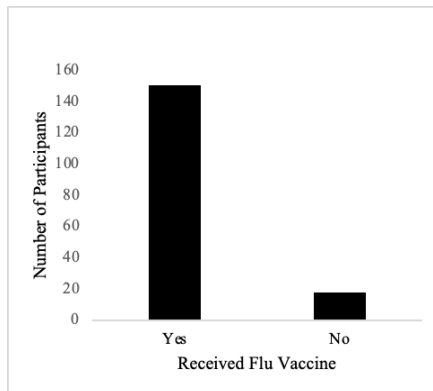

Figure 3. Whether participants have received flu vaccine in the past.150 respondents (89.8%) replied yes, and 17 respondents (10.2%) replied no.
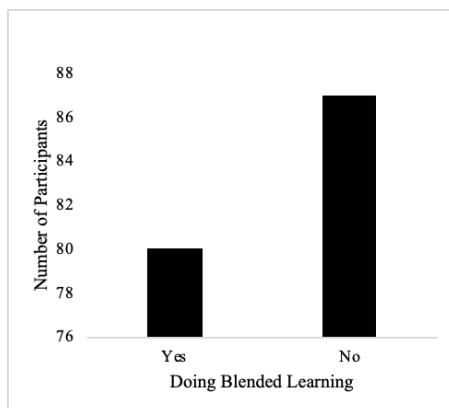

Figure 4. Whether participants will be doing blended learning. 80 participants (47.9%) replied yes, and 87 respondents (52.1%) replied no.
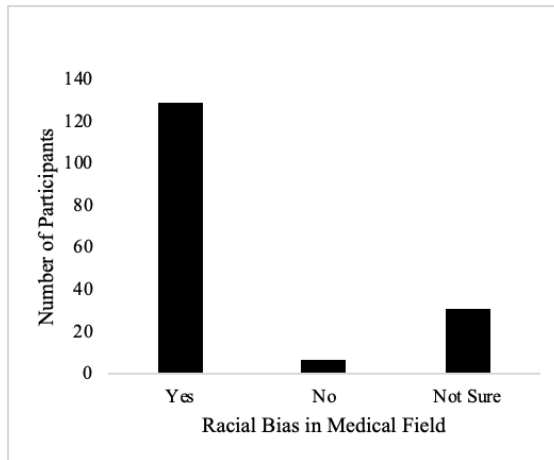
Figure 5. Whether participants believes there is racial bias in the medical field. 129 respondents (77.2%) replied yes, 7 respondents (4.2%) replied no, and 31 respondents (18.6%) replied not sure.
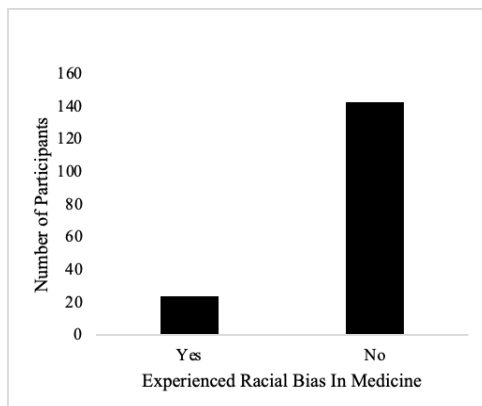

Figure 6. Whether participants have personally experienced racial bias in medicine 143 respondents replied no (85.6%), and 24 respondents (14.4%) replied no.
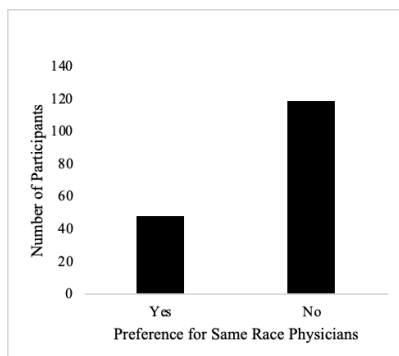

Figure 7. Whether participants have a preference for a same race physician. 48 respondents (28.7%) replied yes, and 119 respondents (71.3%) replied no.
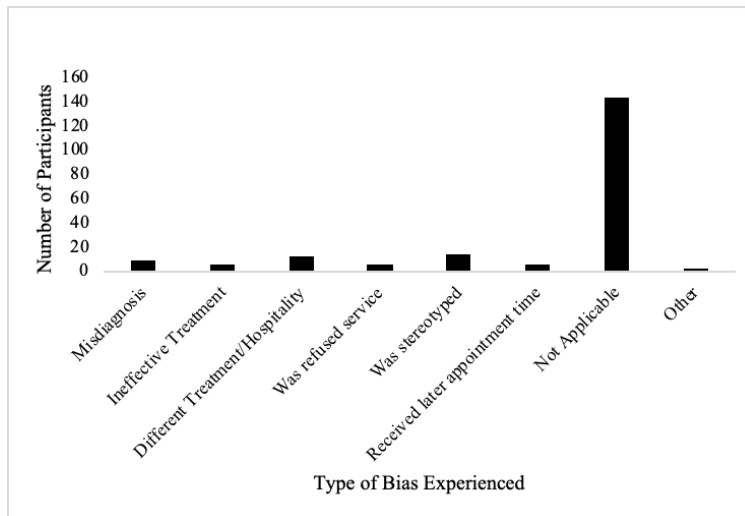
Figure 8. Types of bias participants have personally experienced. 9 respondents (5.4%) have experienced misdiagnosis, 5 (3%) have received treatment that wasn't effective due to race, 5 (3%) have been refused service(s) due to race, 14 (8.4%) have been stereotyped when receiving diagnosis or treatment, 6 (3.6%) have received a later appointment time compared to others, 12 (7.2%) have received different hospitality compared to other patients due to race, 143 (85.6%) have not experienced racial bias, 1 (0.6%) have been gaslighted in the sense that their "issue was [deemed as] just a cultural thing."
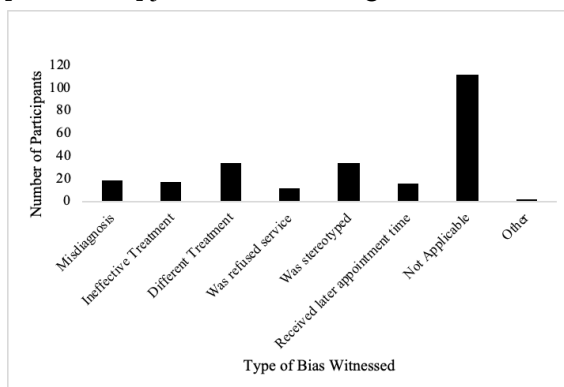

Figure 9. Types of bias participants have witnessed. 19 respondents (11.4%) have witnessed misdiagnosis, 17 (10.2%) have witnessed a patient that received treatment that wasn't effective due to race, 11 (6.6%) have seen someone being refused service(s) due to race, 33 (19.8%) have seen someone who have been stereotyped when receiving diagnosis or treatment, 16 (9.6%) have seen someone who received a later appointment time compared to others, 2 (1.2%) have heard about it through social media, and 110 (65.9%) have not witnessed racial bias.
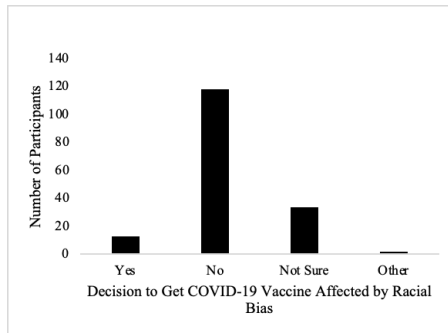
Figure 10. Whether participants' decision to get vaccinated is affected by racial bias. 118 respondents (70.7%) replied no, 13 (7.8%) replied yes, 35 (21%) replied not sure, and 1 (0.6%) replied somewhat.
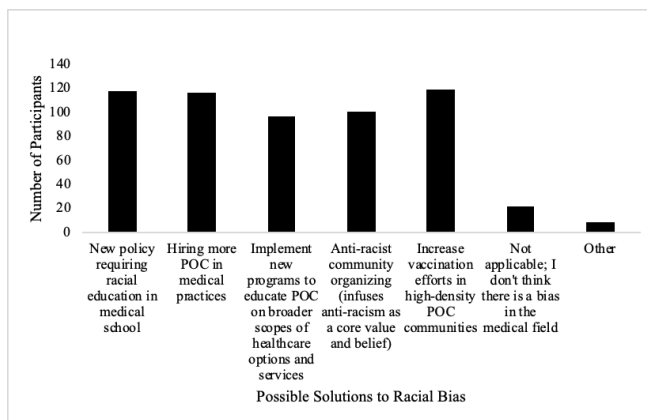

Figure 11. Possible solutions that participants believe could help reduce racial bias. 117 respondents (70.1%) chose new policy requiring racial education in medical school, 116 respondents (69.5%) chose hiring more POC in medical practices, 96 respondents (57.5%) chose implement new programs to educate POC on broader scopes of healthcare options and services, 101 respondents (60.5%) chose anti-racist community organizing, 119 respondents (71.3%) chose increase vaccination efforts in high-density POC communities, 21 respondents (12.6%) chose not applicable, and 8 respondents (4.8%) chose other options including acknowledge of past bias and investigations and insepctions.

Linear Regression

Model Summary – Will you receive the COVID vaccine when you are eligible?/ Have you already received it?

Model	R	R^2	Adjusted R^2	RMSE
H_0	0.000	0.000	0.000	0.333
H_1	0.122	0.015	0.009	0.331

ANOVA ▼

Model		Sum of Squares	df	Mean Square	F	p
H_1	Regression	0.273	1	0.273	2.492	0.116
	Residual	18.086	165	0.110		
	Total	18.359	166			

Note. The intercept model is omitted, as no meaningful information can be shown.

Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p
H_0	(Intercept)	1.126	0.026		43.745	< .001
H_1	(Intercept)	0.975	0.099		9.874	< .001
	In the past, did you get the flu vaccine?	0.137	0.087	0.122	1.579	0.116

Multiple regression analysis was used to test if the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* was affected by the participant's response for *in the past, did you get the flu vaccine*. The proportion of variability accounted for by this model is 0.015 or 1.5%.

A model consisting of the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* did NOT significantly predict the participant's response for *in the past, did you get the flu vaccine*, $F(1, 165) = 2.492$, $p > 0.05$, $p = 0.116$.

Y(*will you receive the COVID vaccine when you are eligible?/ have you already received it?*) = 0.975 + 0.137 (*in the past, did you get the flu vaccine?*)

In the regression model, there is a weak, positive correlation between the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* and *in the past, did you get the flu vaccine*.

When a participant's decision of getting the flu vaccine in the past was the only variable, it was not a significant predictor of our DV ($p > 0.05$, $p = 0.116$).

Model Summary – Will you receive the COVID vaccine when you are eligible?/ Have you already received it? ▼

Model	R	R^2	Adjusted R^2	RMSE
H_0	0.000	0.000	0.000	0.333
H_1	0.002	0.000	−0.006	0.334

ANOVA

Model		Sum of Squares	df	Mean Square	F	p
H_1	Regression	8.603e −5	1	8.603e −5	7.732e −4	0.978
	Residual	18.359	165	0.111		
	Total	18.359	166			

Note. The intercept model is omitted, as no meaningful information can be shown.

Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p
H_0	(Intercept)	1.126	0.026		43.745	< .001
H_1	(Intercept)	1.124	0.083		13.583	< .001
	Are you doing blended learning now? / Do you plan on doing it in the future?	0.001	0.052	0.002	0.028	0.978

Multiple regression analysis was used to test if the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* was affected by the participant's response for *are you doing blended learning now/do you plan on doing it in the future*. The proportion of variability accounted for by this model is 0.000 or 0.0%.

A model consisting of the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* did NOT significantly predict the participant's response for *are you doing blended learning now/do you plan on doing it in the future*, $F(1,165) = 0.0007732$, $p > 0.05$, $p = 0.978$.

Y(*will you receive the COVID vaccine when you are eligible?/ have you already received it?*) = 1.124 + 0.001 (*are you doing blended learning now/do you plan on doing it in the future*)

In the regression model, there is no correlation between the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* and *are you doing blended learning now/do you plan on doing it in the future*.

When a participant's decision of doing blended learning was the only variable, it was not a significant predictor of our DV ($p > 0.05$, $p = 0.978$).

Model Summary – Will you receive the COVID vaccine when you are eligible?/ Have you already received it?

Model	R	R^2	Adjusted R^2	RMSE
H_0	0.000	0.000	0.000	0.333
H_1	0.215	0.046	0.040	0.326

ANOVA ▼

Model		Sum of Squares	df	Mean Square	F	p
H_1	Regression	0.848	1	0.848	7.991	0.005
	Residual	17.511	165	0.106		
	Total	18.359	166			

Note. The intercept model is omitted, as no meaningful information can be shown.

Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p
H_0	(Intercept)	1.126	0.026		43.745	< .001
H_1	(Intercept)	0.997	0.052		19.179	< .001
	Do you think there is racial bias in the medical field?	0.091	0.032	0.215	2.827	0.005

Multiple regression analysis was used to test if the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* was affected by the participant's response for *do you think there is racial bias in the medical field*. The proportion of variability accounted for by this model is 0.046 or 4.6%.

A model consisting of the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* did significantly predict the participant's response for *do you think there is racial bias in the medical field*, $F(1,165) = 7.991$, $p < 0.05$, $p = 0.005$.

Y(*will you receive the COVID vaccine when you are eligible?/ have you already received it?*) = 0.997 + 0.091 (*do you think there is racial bias in the medical field*)

In the regression model, there is a weak, positive correlation between the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* and *do you think there is racial bias in the medical field*.

When a participant's response on whether there is racial bias was the only variable, it was a significant predictor of our DV ($p < 0.05$, $p = 0.005$).

Model Summary – Will you receive the COVID vaccine when you are eligible?/ Have you already received it?

Model	R	R^2	Adjusted R^2	RMSE
H_0	0.000	0.000	0.000	0.333
H_1	0.051	0.003	−0.003	0.333

ANOVA ▼

Model		Sum of Squares	df	Mean Square	F	p
H_1	Regression	0.047	1	0.047	0.423	0.516
	Residual	18.312	165	0.111		
	Total	18.359	166			

Note. The intercept model is omitted, as no meaningful information can be shown.

Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p
H_0	(Intercept)	1.126	0.026		43.745	< .001
H_1	(Intercept)	1.214	0.139		8.748	< .001
	Have you experienced racial bias in medicine?	−0.048	0.073	−0.051	−0.650	0.516

Multiple regression analysis was used to test if the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* was affected by the participant's response for *have you experienced racial bias in medicine*. The proportion of variability accounted for by this model is 0.003 or 0.3%.

A model consisting of the participant's response for *do you think your decision to get the vaccine is affected by the racial bias in the medical field* did NOT significantly predict the participant's response for *have you experienced racial bias in medicine*, $F(1,165) = 0.423$, $p > 0.05$, $p = 0.516$.

Y(*will you receive the COVID vaccine when you are eligible?/ have you already received it?*) = 0.997 - 0.048 (*have you experienced racial bias in medicine*)

In the regression model, there is a weak, positive correlation between the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* and *have you experienced racial bias in medicine*.

When a participant's response on whether they experienced racial bias was the only variable, it was not a significant predictor of our DV ($p > 0.05$, $p = 0.516$).

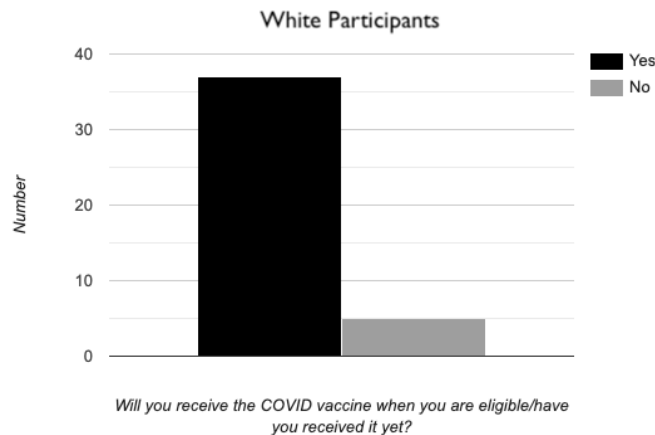*Race/ Ethnicity and Decision to Get COVID-19 Vaccine*

Figure 12. Responses of **White** Participants for Receiving COVID-19 Vaccine. A total of **42** White participants. **88.1%** of this population responded that they **will**/ have already gotten the vaccine and **11.9%** of this population responded that they **will not** get the vaccine when eligible.
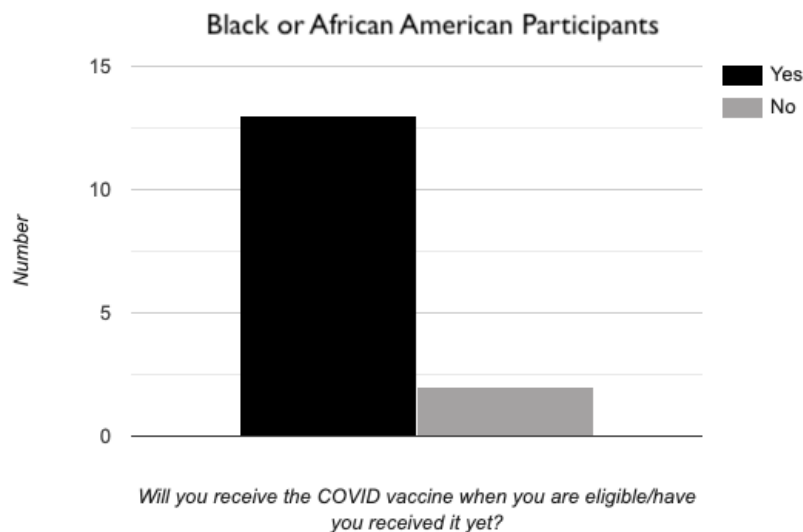

Figure 13. Responses of **Black or African American** Participants for Receiving COVID-19 Vaccine. A total of **15** Black or African American participants. **86.7%** of this population responded they **will**/ have already gotten the vaccine and **13.3%** of this population responded that they **will not** get the vaccine when eligible.
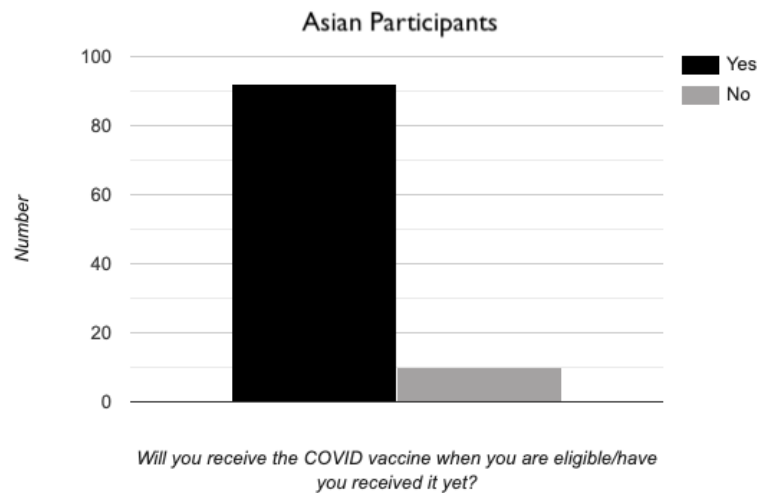
Figure 14. Responses of **Asian** Participants for Receiving COVID-19 Vaccine. A total of **102** Asian participants. **90.2%** of this population responded they **will**/ have already gotten the vaccine and **9.8%** of this population responded that they **will not** get the vaccine when eligible.
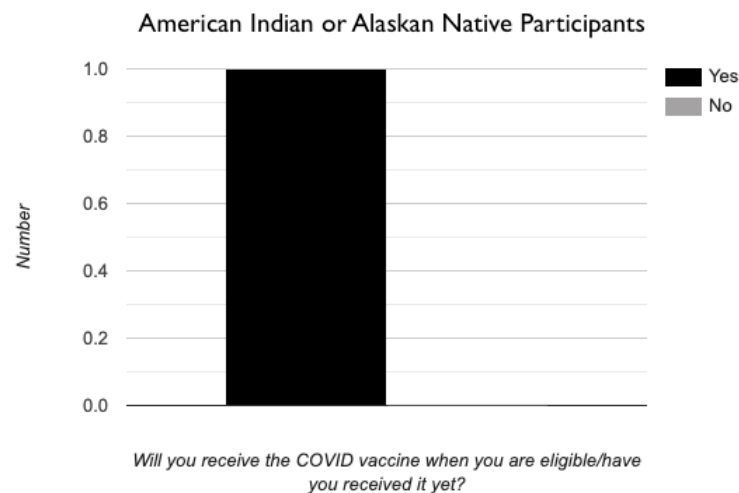

Figure 15. Responses of **American Indian or Alaskan Native** Participants for Receiving COVID-19 Vaccine. A total of **1** American Indian or Alaskan Native participants. **100%** of this population responded they **will**/ have already received the vaccine and **0%** of this population responded that they **will not** get the vaccine when eligible.
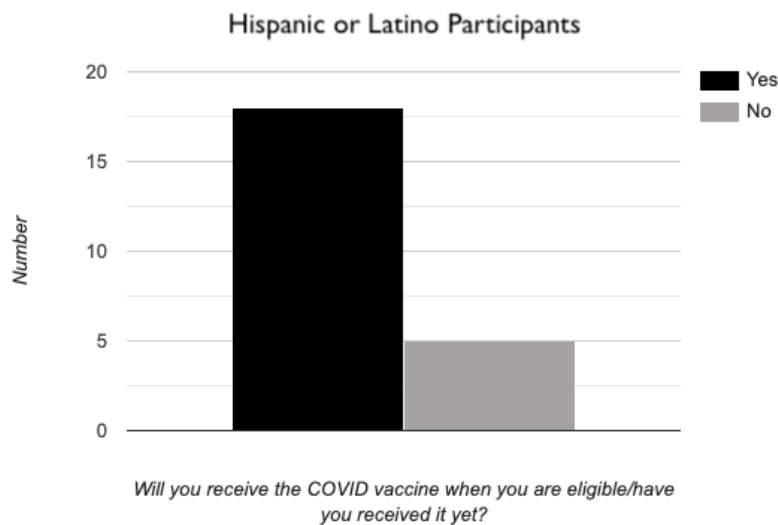
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Figure 16. Responses of **Hispanic or Latino** Participants for Receiving COVID-19 Vaccine. A total of **23** Hispanic or Latino participants. **78.2%** of this population responded they **will**/ have already received the vaccine and **21.8%** of this population responded they **will not** get the vaccine when eligible.
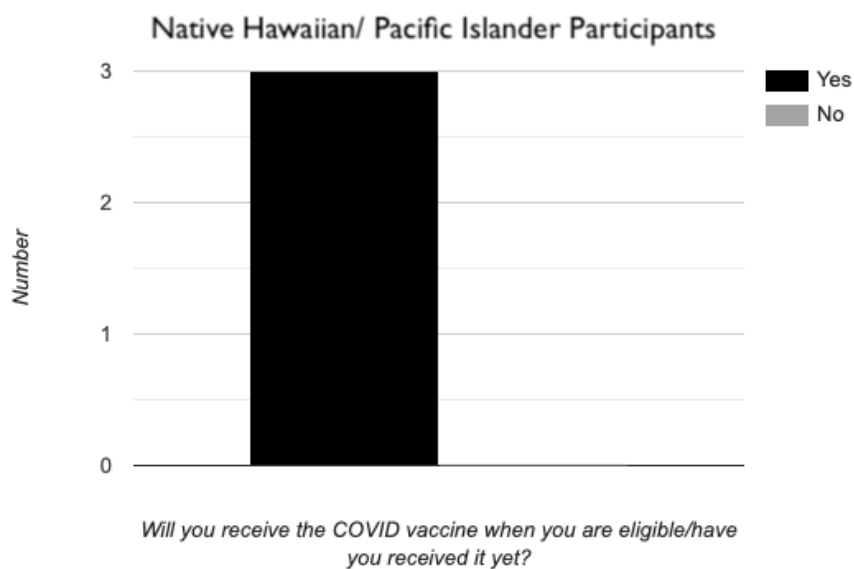

Figure 17. Responses of **Native Hawaiian/ Pacific Islander** Participants for Receiving COVID-19 Vaccine. A total of **3** Native Hawaiian/ Pacific Islander participants. **100%** of this population responded they **will**/ have already received the vaccine and **0%** of this population responded that they **will not** get the vaccine when eligible.

Discussion

Racism in healthcare has been a systematically implemented issue for decades, beginning with medical experimentation on slaves by their owners. Medicine today is written to favor the health of white able-bodied men, while diseased POC may fly under the radar due to different risks and symptoms. Many case studies have shown the mistreatment of POC by healthcare professionals, including the one involving renowned tennis player Serena Williams. Post-birth, Williams, with a pre-existing history of blood clots, informed her medical staff that she was experiencing strange symptoms and felt something was wrong. However, she was brushed off until she got herself out of bed and insisted a CT scan was performed. When performed, doctors found several small blood clots had formed in her lungs. This is just a singular example of the type of discrimination POC, specifically BIPOC women could experience on an everyday basis.

When conducting the literature review, different papers were selected based on how well they could provide evidence to our hypothesis. From analyzing the works mentioned in our literature review, the hypothesis was that BIPOC would be more hesitant in receiving the COVID-19 vaccine, and that many would have experienced medical bias due to race. However, the data concluded that an overwhelming majority of participants had not experienced this type of bias. Therefore, the conducted research did not collect sufficient evidence to support our hypothesis.

While most participants believed that there is racial bias in medicine, the evidence suggested that most of them have not personally experienced racial bias. However, most participants agreed with the possible solutions that were given to help reduce racial bias with nearly 100 participants that chose each possible solution, indicating that these solutions may be chosen by a larger population.

Because the participant pool was majority students, the research factored in whether or not their decision to do blended learning next year would bias their willingness to be vaccinated. The hypothesis was that because certain participants were planning on seeing classrooms full of people next year, they would be more inclined to get vaccinated. However, the collected data did not prove that the relationship between the two variables was significant or had a strong correlation. Therefore, this hypothesis was not supported.

The linear regression models indicated that there are no strong correlations between the variable *will you receive the COVID vaccine when you are eligible/have you already received it* and the other variables that may affect it. The R values for each model was greater but very close to 0, indicating a weak positive correlation. The p values for most models were greater than 0.05, indicating that our data was not significant. The only exception to this was the regression model for the participant's response for *will you receive the COVID vaccine when you are eligible/have you already received it* and the participant's response for *do you think there is racial bias in the medical field*, which had a p value of 0.005. However, due to the small R value, there was only a weak, positive correlation. Therefore, none of the factors that were considered to influence the response for *will you receive the COVID vaccine when you are eligible/have you already received it* were supported to influence that response.

Although there wasn't a strong correlation between race and a participant's decision to get the vaccine, qualitative survey responses indicated participant worries of racial discrimination and its link to vaccine distribution/ treatment when getting the vaccine. Participants also expressed concerns regarding race/ethnicity and getting the COVID-19 vaccine. Some of them were worried about getting a lower quality of care personally or for others based on race. Some were also worried about vaccine availability, being discriminated against while getting the vaccine, allergic reactions to vaccine ingredients, racial discrimination for who can get the vaccine, mistreatment of minorities leading to mistrust of "vaccines [and] medical professionals," and side effects of the vaccine. Overwhelming, respondents who expressed concerns were worried about the racial discrimination they might face when receiving the vaccine or racial-based mistrust of the vaccine and of the medical & healthcare industries in general. Specifically, one respondent indicated their concern regarding going to a hospital without "Asian workers due to the increase in hate towards Asian Americans." Others were concerned about the "past of racial bias in the medical profession," and "that history [might] repeat itself[,] and people of color['s] … trust will be broken once again." This supports results found in our literature review regarding racial discrimination increasing mistrust of the medicial & healthcare industries, particularly for people in color.

The research itself did not produce solid results. This could be due to a multitude of reasons. Firstly, there was an issue in collecting data stemming from a flaw in our survey. When filling out the surveys, many participants did not answer whether or not they were from the United States because the question had not been made mandatory right away. This resulted in having to dismiss responses that had not answered that question in addition to those who had answered from outside of America, giving us a smaller sample population than we'd initially hoped for. Additionally, there may have needed to be an implementation of different methods to reach our expected results. For example, diversifying our population instead of convenience sampling may have helped, as a majority of respondents indicated that they were Asian, with a much smaller number of Black and Hispanic or Latino participants. As aforementioned, the research had been intended to have a majority BIPOC participant pool. In future experiments, purposefully reaching out to BIPOC might produce research to support our hypothesis. Another solution to this issue would be reaching out to different schools/programs for participants instead of relying on responses from personal organizations. In addition, there could be other variables impacting participant's decision to get the vaccine, including allergic reactions to vaccine ingredients preventing them from getting the vaccine, as expressed by two respondents, and efficacy of the vaccine.

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