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Correlation of Race and Income with COVID-19 Vaccination Status in Monroe County, New York

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Abstract

Across the United States, there is a large disparity in vaccination rates for Black, Indigenous, and other People of Color (BIPOC) as well as for those living in poverty. A statistical analysis tests if these same trends apply in Monroe County, a county composed of Rural, Suburban, and Urban zip codes. It is found that the relationship between race and vaccination rate is direct-as the percent of White individuals increase, so does the vaccination rate of that particular zip code. It is also concluded that there is a correlation between high poverty rates and low vaccination rates. Among the multiple factors that lead to this conclusion, hesitancy and accessibility are focused on in this paper. Hesitancy, a leading cause of the lower vaccination rates for BIPOC is an issue that is produced from institutionalized racism in healthcare. For those in poverty, low vaccination rates are caused by insufficient access. Addressing these sources of low vaccination rates will not only benefit Monroe County but can be applied worldwide.

Keywords: Vaccination, hesitancy, accessibility, race, poverty

Introduction

Despite eligibility, only 74.3% of adults in the United States have gotten at least one COVID-19 vaccine, according to the Center for Disease Control and Prevention (CDC). Vaccination rates for People of Color and those in poverty are even lower (COVID-19 Vaccine Effectiveness, 2021). Hesitancy and access are two major causes of vaccination disparities addressed in this analysis. Hesitancy for people in America to receive COVID-19 vaccines stems from social, economic, and political factors. For Black, Indigenous, and other People of Color in the U.S.(BIPOC), systemic racism has been a major cause of lack of trust for the vaccine. BIPOC communities have especially been devastated by the COVID-19 pandemic. For example, Alaskan Natives have had 4 times the amount of COVID-19 deaths as their White counterparts (Quinn & Andrasik, 2021). Additionally, Black Americans have 2-3 times the amount of COVID-19 deaths as White Americans (Bogart et al, 2021). Medical history for BIPOCs in particular has been a part of mistrust, but it is necessary to acknowledge present-day racism in the field attributing to hesitancy (Bajaj & Stanford, 2021).

As stated by the CDC, Pfizer-BioNTech (12 and up), Moderna, and Johnson & Johnson's Janssen are vaccines currently authorized in the United States. High efficacy for these vaccines was studied through multiple clinical trials. Although the available vaccines are safe and effective, BIPOC communities are hesitant. Due to a lack of access, education, or mistrust within the healthcare system, there is a large gap for vaccinations between People of Color and White individuals (Quinn & Andrasik, 2021). For those in poverty, accessibility to get vaccines is lower than

TABLE 1. Excel data table of each zip code with percent vaccination rate, and demographics.

Zipcode	City	County	Vaccination Rate (8/1	White	Black or AA	American Indian ar	Asian	Native Hawaiian an	Mixed	Hispanic a	Persons in Poverty
14614	Rochester	Monroe	31.90%	47.90%	39.80%	1.00%	3.10%	0.10%	4.40%	19.20%	31.30%
14420	Brockport	Monroe	47.40%	86.60%	5.80%	0.10%	3.20%	0.00%	3.20%	5.90%	25.70%
14464	Hamlin	Monroe	48.90%	96.50%	1.70%	0.00%	0.10%	0.00%	1.40%	1.40%	8.60%
14606	Gates-North	Monroe	51.40%	79.50%	11.50%	0.50%	4.20%	0.00%	2.90%	6.00%	7.20%
14609	Irondequoit	Monroe	53.40%	83.70%	10.00%	0.20%	1.30%	0.00%	2.50%	8.80%	8.30%
14445	East Roch	Monroe	59.70%	87.50%	5.70%	1.60%	0.60%	0.20%	3.90%	3.60%	11.90%
14623	Brighton	Monroe	60.50%	79.80%	6.20%	0.50%	10.20%	0.10%	2.50%	5.10%	9.20%
14514	North Chili	Monroe	61.70%	85%	9.60%	0.30%	1.70%	0.10%	2.70%	2.70%	7.20%
14468	Hilton	Monroe	62.80%	91.10%	7.50%	0.00%	0.00%	0.00%	1.00%	4.90%	13%
14626	Greece	Monroe	63.40%	84.60%	8.00%	0.20%	2.80%	0.00%	3.20%	6.10%	9.00%
14467	Henrietta	Monroe	65.30%	75.40%	10.60%	0.10%	9.60%	0.10%	2.70%	4.50%	14.70%
14506	Mendon	Monroe	65.50%	96.60%	1.30%	0.10%	0.80%	0.00%	1.10%	1.10%	7.30%
14580	Webster	Monroe	70.70%	91.90%	2.00%	0.10%	3.40%	0.00%	1.80%	2.90%	4.50%
14428	Churchville	Monroe	72.00%	97.40%	1.20%	0.00%	0.30%	0.00%	1.00%	1.20%	7.80%
14450	Fairport	Monroe	75.40%	97.50%	0.10%	0.70%	0.50%	0.00%	1.20%	5.30%	7.50%
14526	Penfield	Monroe	76.00%	91.80%	2.70%	0.10%	3.40%	0%	1.60%	3.60%	4.20%
14534	Pittsford	Monroe	79.60%	85.80%	1.70%	0.10%	8.70%	0.00%	3.10%	3.20%	3.30%

those of higher income. This is a factor that has historically created the vaccination rate gap between those with higher and lower incomes (Bedford et al, 2018).

I chose my county, Monroe County, New York to see if the same vaccination trends applied. Currently, Monroe County has a vaccination rate of 63.5%. Monroe County is comprised of both rural, suburban, and urban regions, unlike many counties in New York. According to the 2020 Census, out of a population of around 720,000 residents, approximately 30% live in The City of Rochester, 64% live in suburban neighborhoods, and 6% are from rural areas. Vaccination rates for various zip codes vary drastically. With the variety of residential areas in Monroe, the demographics of race and income also varies (United States Census Bureau, 2021).

Objectives

Find the correlation between vaccination rate and race for each Monroe County zip code as well as the correlation between vaccination rate and poverty.

Hypothesis

H_1: As the percent of White individuals in a zip code increase, the vaccination rate will also increase.

H_2: As the poverty rate increases in each zip code, the vaccination rate will decrease.

Methodology

For this study, data was collected for vaccination rates and zip code demographics. First, I collected vaccination rates from all Monroe County zip codes from the New York State COVID-19 vaccine tracker. I then collected race and income data from all Monroe County zip codes from the United States Census Bureau. For each zip code, I took data for percent race and percent in poverty. Out of the 43 zip codes that I found vaccination rates for, 17 had demographic data in the United States Census Bureau. Therefore, my statistical analysis used data from 17 Monroe County zip codes. For all of the statistical tests, SAS software was used. For both the race vs. vaccination rate test and the poverty vs. vaccination rate test, a Pearson correlation coefficient was found. Lastly, the measures of spread were also found using the three variables (vaccination rate, percent white, and poverty). All statistical tests were two-sided and a p-value of <0.05 was considered statistically significant.

Results

First, the measures of spread were calculated. The majority of the vaccination rates that were collected were greater than 46%, mean = 61.5% ± 12.2%.

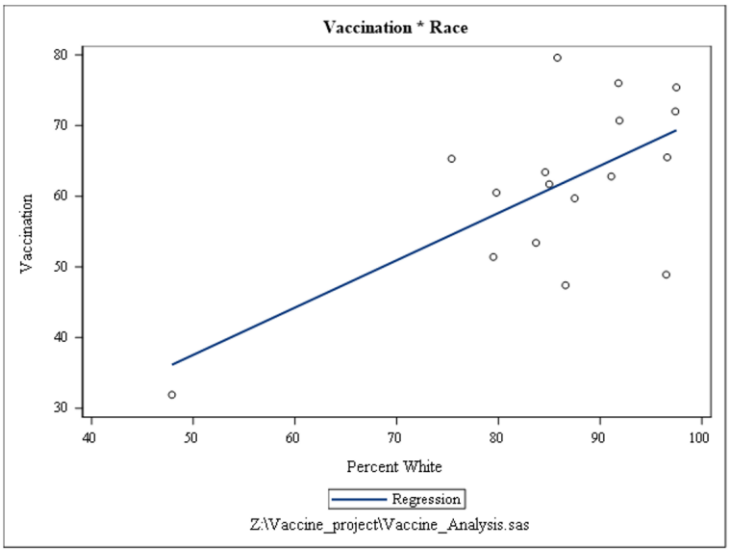
TABLE 1. Measures of spread for vaccination rate, percent white, and percent poverty.

Variable	N	Mean	Std Dev	Median	Min	Max
Vaccination	17	61.50588	12.16380	62.80000	31.90000	79.60000
Percent White	17	85.80000	11.81673	86.60000	47.90000	97.50000
Poverty	17	10.62941	8.30000	8.30000	3.30000	31.30000

To determine if there was a relationship between vaccination rate and race in Monroe County, a Pearson correlation coefficient was found. Vaccination rate and race in Monroe County were found to be significantly positively correlated, r(15) = 0.650, p = 0.0047. As the percent of White individuals in a zip code increased, there was an increase in the vaccination rate.

TABLE 3. Measures of correlation for percent white and percent poverty.

Vaccination Rate and	Pearson Correlation Coefficient	p-value
% White	0.650	0.005
Poverty	-0.763	<0.001



A Pearson test was calculated to show the correlation between the vaccination rate and the percent of individuals in poverty in Monroe County. Vaccination rate and poverty were found to be significantly negatively correlated, r(15) = -0.763, p = 0.0004. The data shows that as the poverty rate increased in a zip code, the vaccination rate decreased.

TABLE 3. Measures of correlation for percent white and percent poverty.

Vaccination Rate and	Pearson Correlation Coefficient	p-value
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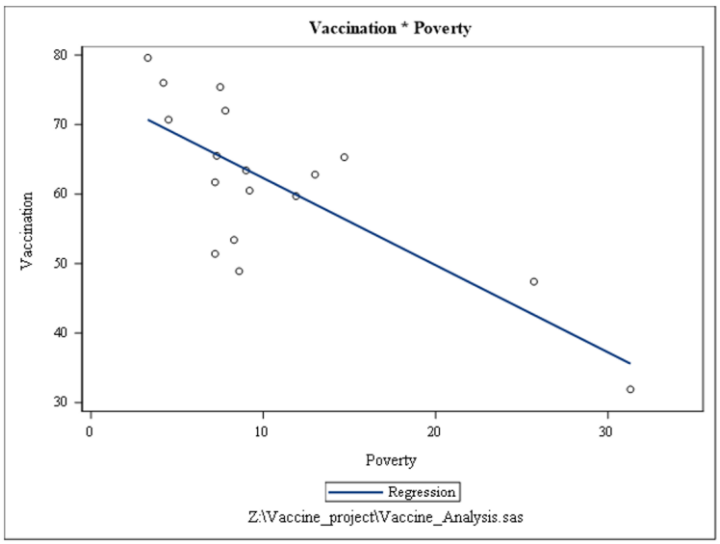

Discussion

Vaccination Rate vs. Race

The results of the Monroe County race vs. vaccination rate analysis are similar to vaccination disparities across the United States (Quinn & Andrasik, 2021). The data support my null hypothesis that as the percent of white individuals in a zip code increase, the vaccination rate will also increase. Concluded by the correlation coefficient of 0.650, it is evident that there is a significant correlation between race and vaccination rate. Due to previous trends in vaccination rates for People of Color, these findings were not surprising.

One logical reason concluding my findings is BIPOC vaccine hesitation, stemmed from mistrust. Not just COVID-19 vaccinations, but a history of minority vaccine hesitancy has been researched. For example, results for a study of the disparity in flu vaccination rates between White adults and Black adults were significant. Black adults were surveyed to have less knowledge about the vaccine, a greater amount of racial

consciousness, and lower trust in the flu vaccine. Furthermore, Black adults had a notably lower flu vaccination rate than White adults (Quinn et al, 2021). The lack of diversity in the medical system also creates a lack of trust within BIPOC communities. In a study led by Dr. Sandra C. Quinn, the impact of diversity was tested on the influenza vaccination. The study found that "perceived racial fairness" in the vaccination system created trust in the influenza vaccine. The perceived risk of side effects also increased with discrimination (Quinn & Andrasik, 2021).

Vaccination opportunities could be another factor explaining the varied data. For the flu season in 2009-2010, opportunities for getting vaccinated were observed in a study. Results indicated that there were significantly more "missed vaccination opportunities" (unvaccinated individuals who had a healthcare visit) for minorities than non-Hispanic Whites. Without equitable access to vaccines, there will be a gap in vaccination percentages (Maurer, Harris, & Uscher-Pines, 2014).

To increase COVID-19 vaccine intake for the BIPOC communities, both vaccine hesitation and opportunities need to be addressed. To make health institutions more trustworthy to BIPOC individuals, systemic racism needs to be eradicated. One feasible approach to this is for health care workers to engage with BIPOC communities more, and for providers to use motivational interviewing to address any mistrust (Gagneur, 2020). This process could include healthcare workers asking BIPOC communities about their needs to feel safe when it comes to healthcare, and what current policies are acting as obstacles to their confidence in the system, and later collecting and analyzing the results for future improvements. Another way to increase confidence in the vaccine is to let BIPOC physicians educate their communities. Racial identity can affect BIPOC's response to receiving COVID-19 information. For example, Black patients had a more positive response to a video promoting COVID-19 precautions led by a Black physician than by a physician of another race (Bajaj & Stanford, 2021). To increase vaccine-rollout efforts, race concordance could be a key component. Trust is one of the barriers to vaccination uptake in the BIPOC community, and by increasing the sense of security in the medical system, trust will ultimately increase (Kestenbaum, 2015).

To create more vaccination opportunities for BIPOC communities, routine healthcare visits need to be encouraged, and within those visits, vaccines should be highly recommended (Maurer, Harris, & Uscher-Pines, 2014). Although entirely eliminating systemic racism in healthcare is impractical, many steps can be taken to reduce its effects. By doing this, the rates for COVID-19 vaccinations for BIPOC zip codes can increase.

Vaccination Rate vs. Poverty Rate

The analysis also supported my null hypothesis that as the percent of individuals in poverty increases, the vaccination rate will decrease. These results are similar to those across the U.S. Research about vaccine accessibility for those living in poverty also shows lower rates of vaccinations, therefore these results are not surprising.

Although race also correlated with the vaccination rate, my analysis suggests that poverty has a stronger relationship. The results from my Monroe County analysis outcome are similar to that of previous vaccinations. For instance, a systematic review was done for human papillomavirus (HPV) vaccinations in 2014. From this analysis, it was found that 1% out of 118 million women in immunization programs were low-income (Bruni et al, 2016).

Many factors contribute to the historic inequity of accessible vaccines. Accessibility to the COVID-19 vaccines is the leading cause of the variation in the vaccination rates I analyzed. Struggling to get vaccination appointments is an example of the effects of inaccessibility for low-income individuals. Many COVID-19 vaccination centers are set up in areas that are hard to access due to variables such as transportation, work schedules, and disabilities. Additionally, online vaccine registration has disadvantaged those without

access to technology (Quinn & Andrasik, 2021). Addressing these factors will not only increase COVID-19 rates, but also for other vaccines (Lu, Gandi, & Morgan, 2021).

One approach to increase vaccine accessibility is to go out to low-income communities for vaccinations. This way, transportation, and online registration issues are eliminated. Work schedules can also be better accommodated. Availability at large sites can also be slim, therefore vaccination outreach clinics will provide more opportunities (Lu, Gandi, & Morgan, 2021).

Limitations

A limitation of this study is from the data that I had collected from the New York State COVID-19 Vaccine Tracker, as the site does not gather data about age. The Pfizer-BioNTech vaccine is approved for people ages 12 and up only. Since the data does not take into account age, the true vaccination rates for eligibility aren't clear. Additional research could be done to only account for the ages that are eligible for the vaccine. For example, taking a census of only those who are vaccine-eligible and conducting the same statistical analysis.

Future research surrounding the impacts of BIPOC community engagement could be done to obtain knowledge about COVID-19 vaccine hesitancy. Surveying BIPOC communities about why they wish to not receive that vaccine could help. If Monroe County was able to collect data on why People of Color who have not yet received the vaccine are doubtful (through surveys and community outreach), reasons for hesitancy can be better addressed. These statistics would be able to tell us how to increase vaccination rates in Monroe County and eventually apply this across the United States. Two major hospitals in Monroe County, the University of Rochester, and Rochester Regional Health, have done work to reach those zip codes with lower vaccination rates. For example, Dr. Angela Branche, a Black physician at the University of Rochester, has increased the COVID-19 vaccine trial enrollment in the Black community using door-to-door outreach. Along with Dr. Branche's community engagement, Sister Marsha Allen, a Black ordained minister in Rochester, has spread education to some of the poorest and predominantly POC neighborhoods in Monroe County using the same door-to-door approach (Steenhuysen, 2021). I have had the opportunity to help Sister Marsha Allen at a COVID-19 vaccination located in the City of Rochester clinic where vaccines are offered. The clinic has made an impact on zip codes that otherwise would have lower rates of vaccination. This work that improves the health of both BIPOC and low-income communities will be a factor in minimizing the COVID-19 pandemic.

Conclusions

It is known that poverty and race are correlated to past vaccination trends in the United States. My analysis suggested that the trends apply to COVID-19 vaccinations in individual communities as well. To conclude, race and vaccination rate correlate, as well as poverty and vaccination rate. Multiple factors are causing these statistics. Vaccine hesitancy and accessibility not only affects my community, but all of the United States. It is important to address these variables to increase vaccination rates in BIPOC communities as well as low-income communities to reduce the longevity of the COVID-19 pandemic.

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