An Intersectional Analysis of Increasing Vaccine Skepticism: Women of Color

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I. Introduction

The United States has one of the highest rates of vaccine skepticism. (Sallam 2021). As of October 2022, about 2.5 years after the initial outbreak broke out in the US, only 68% of Americans had received a full vaccination course, and only ⅓ had received a booster shot. The especially high rate of vaccine skepticism might be explained by a culture deeply rooted in individualism. However, this cannot explain the increase in vaccine hesitancy in recent years. Vaccine support in the United States has been on the decline in recent years, reflecting a growing trend of skepticism toward public health recommendations (Fridman et al., 2021). Since March of 2020, when the US started to get serious numbers of Covid-19 cases, and December 2020, with the subsequent release of a vaccine, the topic of vaccinations and possible side effects has come into the limelight. Despite healthcare professionals urging the public to get vaccinated if possible, misinformation gained traction in the news and on social media. As a result, many became more skeptical of vaccination in general. From 2020 to 2024, the percentage of Americans who believed that the health benefits of vaccines did not outweigh the costs increased from 24% to 33% (ANES). In order to address this gap, this paper investigates why vaccine attitudes changed between 2020-2024 for some people, but not others.

The importance of vaccines in healthcare cannot be understated. An estimated 154 million lives have been saved by vaccinations in the last 50 years (WHO 2024). This trend of decreasing support for vaccinations could have drastic consequences on public health. The longer it takes to control the spread of an illness, the more time it has to mutate, creating mutations of the virus that are possibly more deadly or vaccine-resistant. During the Covid-19 pandemic, those who chose not to get vaccinated contributed to the burden on healthcare facilities. Additionally, the increased skepticism toward vaccines caused civil unrest in the

context of vaccine mandates. The proposal of vaccine mandates either by the government or private firms, in an attempt to promote public safety, has become highly contentious as vaccine dissent continues to grow.

This shift in vaccine perceptions has been tied to many demographic factors, such as race, gender and income, as well as ideological factors such as political beliefs and trust in Public Health Institutions (PHIs). However, research has found mixed and often conflicting results regarding these factors, suggesting the question of vaccine attitudes is a complex and multi-faceted problem. There is less discussion around intersectionality, specifically as it pertains to race and gender. Racial minorities and women are more likely to receive inadequate healthcare and be neglected by medical professionals. This can have catastrophic consequences, because trust in PHIs comprises a major role in predictions of vaccine attitudes. This paper aims to examine the effect of intersectionality identity for women of color on vaccine attitudes.

The rest of this paper is organized into five parts. First, I will situate this paper within the broader discussion of literature on vaccine hesitancy. Second, I will outline the theory underlying the influence of racial and gender intersectionality on vaccine attitudes. Third, I will lay out my research design, and then I will discuss the results. Finally, I will discuss the implications of the findings for public health.

II. Establishing the Discussion on Vaccine Hesitancy in the U.S.:

Due to the importance of widespread inoculation for public health, scholars have worked to investigate the causes of vaccine hesitancy. One major source of the rising vaccine skepticism since the outbreak of Covid-19 is the prevalence of misinformation and conspiracies. The impact of misinformation on vaccine hesitancy is nuanced, with misinformation ranging from medical to political (Zimmerman et al. 2022). Misinformation has been affecting vaccine opinions before

Covid-19, but it was even more rampant during the Covid pandemic (Zimmerman et al. 2022), which makes it a plausible explanation for the decrease in vaccine support from 2020 to 2024. However, despite misinformation having a strong correlation with vaccine hesitancy, it doesn't explain much variation in vaccine hesitancy as it is endogenous to vaccine hesitancy (Stoler et al. 2022). In the same vein, conspiracy mentality has a positive relationship with vaccine hesitancy, although there are mixed results on whether this relationship is statistically significant (Jennings et al. 2023 & Stoler et al. 2022). Conspiratorial beliefs that people cited as their reason for remaining unvaccinated ranged from political, such as the belief that Covid-19 was planned to help get Donald Trump get elected, or the belief that the vaccine rearranges DNA (Zimmerman et al. 2022).

In addition to misinformation and conspiracy mentality, political ideology is naturally thought to play a role in opinions surrounding vaccines. Trump was outwardly critical of Covid-19 precautions such as masking, social distancing, and vaccines. Biden was more supportive of such measures, so it is no surprise that attitudes around the Covid-19 vaccine differ between Democrats and Republicans. Democrats support both the Covid-19 vaccine and vaccines in general more than Republicans (Choi & Fox, 2022, Fridman et al. 2021). While support for vaccines in general has decreased for both parties, the decline in Republican support for vaccines has declined more sharply than that of Democrats (Fridman et al., 2021). Furthermore, support for Trump is positively associated with being unvaccinated against Covid-19 (Stoler et al. 2022). On the other hand, Amalani et al. asserts that social network is a better predictor than partisanship; those with more vaccinated people in their social circle are more likely to get vaccinated, regardless of party affiliation (2023). Therefore, the effect of political affiliation on vaccine attitudes is conflicting. The possible confounding effect of the

impact of one's social network suggests that partisanship itself is less correlated with vaccine attitudes than it would seem. The evidence indicates that other factors are important regarding predictions of vaccine perceptions.

In addition to ideological factors, demographic factors have been explored in the search for accurate predictors of vaccine support. Higher education is positively related with willingness to get the Covid-19 vaccine (Jennings et al. 2023, Nguyen et al. 2022, Dorman et al. 2022, Kelly et al. 2021, Morales et al. 2022). However, this effect may be statistically insignificant after including control variables beyond basic demographic details (Stoler et al. 2022). Similarly, income level holds a positive relationship with vaccination status (Stoler et al. 2022, Kim et al. 2022, Bass et al. 2021, Kelly et al. 2021); however, the findings are conflicting as to whether this relationship is statistically significant (Thunström et al. 2021). This discrepancy is further complicated by the finding that income is statistically significant for women (with a positive relationship to support for the Covid-19 vaccine), but insignificant for men (Morales et al. 2022). As is the case with political affiliation, the impact of income on vaccine attitudes is contested. In addition to education and income, older age has a positive relationship with vaccine willingness. People 65 and older were generally more willing to get the Covid-19 vaccine (Choi & Fox 2022, Jennings et al. 2023, Nguyen et al. 2022, Stoler et al 2022, Kelly et al. 2021). This is likely due to the increased risk of fatality from Covid-19 in this age group.

Finally, race and gender are found to be correlated with vaccine attitudes. In regard to the Covid-19 vaccine, White Americans and Asian Americans have higher rates of vaccination, and Black or Latinx Americans have lower rates of vaccination (Stoler et al. 2022, Dorman et al. 2021, Kelly et al. 2021, Bass et al. 2021). Interestingly, Black Americans were three times as likely to wear a facial covering most or all of the time as compared to White Americans (Nguyen

et al. 2022). This suggests a willingness to adhere to Covid-19 protocols, but a hesitancy around the safety of the vaccine specifically, rather than priorities of personal freedom or conspiratorial thinking. Notably, a similar trend is observed for women. Females were more likely to wear a facial covering than males (Nguyen et al. 2022), but were less likely to get vaccinated (Bass et al. 2021, Dorman et al. 2021, Kelly et al. 2021, Thunström et al. 2021).

Morales et al. found that intersectional analysis of demographic factors is important: poverty is positively correlated with vaccine hesitancy in women but not with men (2022). The intersection of race and gender is interesting because of the importance of trust in medical institutions to vaccine support (Choi & Fox 2022), in conjunction with the fact that racial minorities and women are more likely to experience medical discrimination (Bazargan et al. 2021, Al Hamid et al. 2024). This suggests a possible causal effect, in which medical discrimination against women of color leads to lower vaccination rates due to lessened trust in the medical system. In this paper, my statistical analysis will explore the effect of intersectional identity on vaccine hesitancy.

III. Race, Gender, & Medical Mistrust

The topic of intersectionality has gained traction, especially in recent years, but it first entered the discussion of political science in the late 1980s. Analyzing vaccine attitudes through an intersectional lens means examining how multiple aspects of a person's identity jointly shape their experiences and beliefs. Investigating the intersection of identities is important because, for women of color, the experiences of gender discrimination are influenced by their race, and the experiences of racial discrimination are influenced by their gender (Crenshaw 1991).

The importance of an intersectional analysis in the context of vaccine hesitancy lies in the efficacy of proposed solutions. At the heart of the discussion around vaccine hesitancy is an

effort to find the most predictive factors, with the goal of ultimately understanding the discrepancy in vaccine beliefs and coming up with a solution that decreases this gap. In other words, the factors driving vaccine hesitancy among intersecting identities must be understood to propose an effective solution. If this intersectional identity of being a gender minority and a racial minority, intervention strategies that attempt to decrease vaccine hesitancy without taking into account the interaction between race and gender are likely to be unsuccessful.

There were important societal changes from 2020 to 2024. While Covid-19 cases were rising in 2020, racial unrest also increased. Protests against Police Brutality towards Black people became more prevalent than before, and Black Lives Matter, an established political movement, gained significant publicity (Anderson et al. 2020). While police brutality against Black Americans was occurring long before 2020 (and since), highly publicized incidents of brutality caused it to become a prominent political discussion. Additionally, hate crimes and racism toward Asian people were also on the rise. In fact, from 2019 to 2020, hate crimes toward Black and Asian Americans increased by 49% and 77%, respectively (U.S. Department of Justice, 2023). The racial unrest, in combination with the Covid-19 pandemic, contributed to a social and political environment that still influences people's vaccine attitudes and trust in institutions.

Discrimination against racial minorities and women is widespread within the medical system. Both people of color and women are more likely to face poor health outcomes (Campbell et al. 2025, Al Hamid et al. 2024). White patients. For example, Black, Mexican, and Puerto Rican patients are more likely to report experiencing medical discrimination in the form of receiving poorer service, being treated with less respect, and having doctors or nurses who do not listen to them (Benjamins & Middleton 2019). Additionally, doctors are more likely to dismiss

risk factors for cardiovascular disease (CVD) in women, and women were offered less diagnostic testing for CVD and fewer referrals to specialists (Al Hamid et al. 2024). Furthermore, this discrimination is compounded for women of color. As an example, White women are twice as likely to be screened for cervical cancer and have a much lower rate of mortality from cervical cancer (Washington & Randall 2022). Additionally, about one in three Asian American women reports experiencing discrimination from medical professionals (Do et al 2022). This discrimination is a contributing factor to the higher levels of medical mistrust and avoidance of care observed in people of color and women (Campbell et al. 2025, Bazargan et al 2021, Do et al 2022). This is a crucial finding because mistrust in medical experts and the healthcare system contributes heavily to vaccine hesitancy (Silver et al. 2022, Morgan et al., Choi & Fox 2022, Nanaw et al. 2024). The aim of this paper is to analyze how the intersection of race and gender, specifically for women of color, influences vaccine attitudes.

IV. Research Design

In order to test my theory, I utilized the American National Election Survey data from 2020. The initial interviews were collected from 8,280 individuals starting in August 2020 up until election day on November 3, 2020. The post-election interviews were conducted with 7,449 individuals starting after the election and continuing through the end of December. The data were collected through three channels: web, web/phone hybrid, and web/phone/video hybrid interviews.

A strength of this data is its large sample size. Additionally, its inclusion of a wide spread of both demographic and ideological variables makes it a good fit for the question at hand. However, the data also has some limitations. Firstly, it does not directly measure trust in public health institutions. As a result, trust in the healthcare system is the most prominent variable in the

literature around vaccine hesitancy that cannot be accounted for in this model. In addition, this data also relies upon self-reported values from participants. That is less of an issue for the variables included in this model, which tend to be less subjective; however, it is possible that people still gave incorrect information. Finally, by conflating sex assigned at birth with gender identity, the study may obscure nuances in how gender presentation affects vaccine hesitancy, though the overall results are still informative.

Vaccine Hesitancy. In order to ascertain vaccine hesitancy, I am using a 7-point variable that measures how people perceive vaccine risks and benefits. Higher values indicate more vaccine hesitancy, i.e. that health risks of vaccines outweigh the benefits. This variable has a mean of 2.034, with a standard deviation of 1.433.

Race. For this analysis, I added three additional dichotomous variables in order to analyze the effect of being a racial minority on vaccine attitudes. I have one variable for Non-white, encompassing all groups besides white, another binary variable for those who identify as Black, and one for those who identify as Asian. In addition to the Non-white variable, I chose to look more closely at Black and Asian responses in particular due to the uptick in racial unrest and hate crimes being especially high for those two groups in 2020 (U.S. Department of Justice, 2023). For the Black variable, those who identified as “Black non-Hispanic” were assigned a value of one, and all other responses were assigned 0. Then I replicated the process for respondents who identified as “Asian or Native Hawaiian/other Pacific Islander”. The proportion of respondents who are Black or Asian is 0.089 and 0.035, respectively.

Conspiratorial Thinking. To measure conspiratorial thinking, I utilize the variable that asks respondents, “How well does the following statement describe your view? ‘Much of what people hear in schools and the media are lies designed to keep people from learning the real truth

about those in power.'" Respondents can answer on a five-point scale from 'Not at all' to 'Extremely well'. This variable has a mean of 1.789, with a standard deviation of 1.253.

Party ID. Political affiliation was measured with a seven-point party ID scale. The possible responses included Strong Democrat, Not Very Strong Democrat, Independent-Democrat, Independent, Independent-Republican, Not Very Strong Republican, and Strong Republican. This variable has a mean of 2.888, with a standard deviation of 2.254.

Fox News watcher. I include a variable taking into account where respondents source their news, specifically those who watch Fox News. I chose Fox News because it is associated with the highest rate of uncorrected misinformation regarding coverage on Covid-19 (Maloney et al 2024). The literature suggests that misinformation is an important factor in determining vaccine attitudes. To capture this, I utilized the dichotomous variables that record whether the respondent reports having watched a specified TV program at least once a month. This survey includes questions about TV programs from Fox, MSNBC, CNN, CBS, ABC, PBS, and NBC. There are seven TV programs from Fox News included in the data. In order to ascertain which respondents watch Fox News on a regular basis, respondents who reported watching any of these seven news programs from Fox News are assigned a value of 1. Respondents who did not report watching any programs from Fox News at least once a month were assigned 0 for this variable. The proportion of respondents who watched at least one program from Fox News is 0.223.

Sex, income, and education. Additionally, some demographic factors were taken into account, which were coded in a straightforward manner. Sex is recorded as 1 for female, 0 for male. The proportion of respondents who identified as female is 0.542. To measure income, respondents place themselves in one of 22 income groups: "Under $9,000", "$10,000-14,999", and so on, with the highest category being "$250,000 or more". The average position of respondents along

the income scale from 0 to 21 was 10.75, and the standard deviation for this variable is 6.752. Finally, education was measured on a five-point scale: Less than high school education (0), High school (1), Some post-High School (2), Bachelor's degree (3), and graduate degree (4). The average level of education among respondents was 2.387, with a standard deviation of 1.110.

For this analysis, I will be running two Ordinary Least Squares Regressions. I will estimate the relationship between vaccine hesitancy, sex, and race by finding the best-fitting linear equation.

Regression Equations:

Model 1. $VaccineHesitancy_i = \beta_0 + \beta_1 Female_i + \beta_2 Non\text{-}white_i + \beta_3(Female_i * Non\text{-}white_i) + \beta_4 Income_i + \beta_5 Education_i + \beta_6 WatchesFoxNews_i + \beta_7 ConspiracyMentality_i + \beta_8 Republican_i + \varepsilon_i$

Model 2. $VaccineHesitancy_i = \beta_0 + \beta_1 Female_i + \beta_2 Black_i + \beta_3(Female_i * Black_i) + \beta_4 Asian_i + \beta_5(Female_i * Asian_i) + \beta_6 Income_i + \beta_7 Education_i + \beta_8 WatchesFoxNews_i + \beta_9 ConspiracyMentality_i + \beta_{10} Republican_i + \varepsilon_i$

Hypotheses:

Race:

$$H_0 : \beta Non\text{-}white_i = 0 \qquad H_1 : \beta Non\text{-}white_i > 0$$

$$H_0 : \beta Black_i = 0 \qquad H_1 : \beta Black_i > 0$$

$$H_0 : \beta Asian_i = 0 \qquad H_1 : \beta Asian_i > 0$$

Gender:

$$H_0 : \beta Female_i = 0 \qquad H_1 : \beta Female_i > 0$$

Race x Gender:

$$H_0 : \beta(Non\text{-}white * Female)_i = 0 \qquad H_1 : \beta(Non\text{-}white * Female)_i > 0$$

$$H_0 : \beta(Black * Female)_i = 0 \qquad H_1 : \beta(Black * Female)_i > 0$$

$$H_0 : \beta(Asian * Female)_i = 0 \qquad H_1 : \beta(Asian * Female)_i > 0$$

If the interaction variable between race and gender has a statistically significant positive coefficient, that suggests that I can reject the null hypothesis that being a woman of color is not associated with higher vaccine hesitancy than would be expected from the sum of the individual effects of race and gender alone.

For this regression model, I make a few assumptions. Firstly, I assume that the parameters are linear. Additionally, I assume that observations are independent of one another, meaning the respondents were chosen at random. I assume that independent variables are not correlated with the error term and that independent variables are not highly correlated with one another. Finally, I assume that error is distributed normally throughout the data and that the variance of the error term is constant.

I ran diagnostic tests in order to identify possible violations of my regression assumptions. First, I ran a variance inflation test, which returned results that did not show evidence of multicollinearity. Next, I ran a Breusch Pagan Test, which indicated that both models did violate the assumption of homoskedasticity. As a result, I reran the model with robust standard errors. To check for potential autocorrelation, I ran a Breusch-Godfrey test, which did not show evidence of autocorrelation. Additionally, I ran a Ramsey's reset test, which indicated that both models have endogeneity. Finally, a Cook's distance test revealed that there are quite a few influential data points.

V. Results

My estimation strategy for this analysis is an Ordinary Least Squares Regression. An OLS regression determines what portion of the variance in vaccine hesitancy can be explained by an intersectional identity of women of color. In order to estimate the true effect of race and gender on vaccine attitudes, I will also include other variables that may affect vaccine attitudes.

This will allow me to control for outside effects and find the impact that gender and race alone have on vaccine attitudes.

For my analysis, I am using a threshold of 0.05 for statistical significance. My first model finds that being non-white, possessing conspiratorial beliefs, and identifying as a republican have a statistically significant positive effect on vaccine hesitancy, while income and education have a statistically significant negative relationship with vaccine hesitancy. For the variables which had statistically significant findings, the full effect sizes on a 7 point-scale of vaccine hesitancy are as follows: being female (-0.027), being non-white (0.571), conspiratorial thinking (1.025), identifying as Republican (0.399), watching Fox News (-0.079), income (-0.572), and education (-0.845), and being non-white and female (0.126). The full effect sizes divided by the standard deviation of the dependent variable are as follows: being female (-0.019), being non-white (0.398), conspiratorial thinking (0.715), identifying as Republican (0.279), watching Fox News (-0.055), income (-0.399), education (-0.59), and being non-white and female (0.088). The coefficient for the interaction variable between non-white and female is positive (0.126), but relatively small and not statistically significant.

My second model finds similar results for the control variables in both effect size and statistical significance, although being a Fox News watcher is statistically significant only in model 2. In model 2, I replaced the dichotomous non-white variable with dichotomous Black and Asian variables. Model 2 finds a positive relationship between being Black or Asian and vaccine hesitancy, although only the coefficient for the Black variable is statistically significant. The full effect sizes on a 7 point-scale of vaccine hesitancy are as follows: being female (-0.022), being Black (0.922), conspiratorial thinking (1.05), identifying as Republican (0.392), watching Fox News (-0.095), income (-0.572), education (-0.865), being Asian (0.67), being Black and female

(-0.145), and being Asian and female (0.545). The full effect sizes divided by the standard deviation of the dependent variable are as follows: being female (-0.015), being Black (0.643), conspiratorial thinking (0.735), identifying as Republican (0.273), watching Fox News (-0.066), income (-0.396), education (-0.605), being Asian (0.467), being Black and female (-0.101), and being Asian and female (0.380).

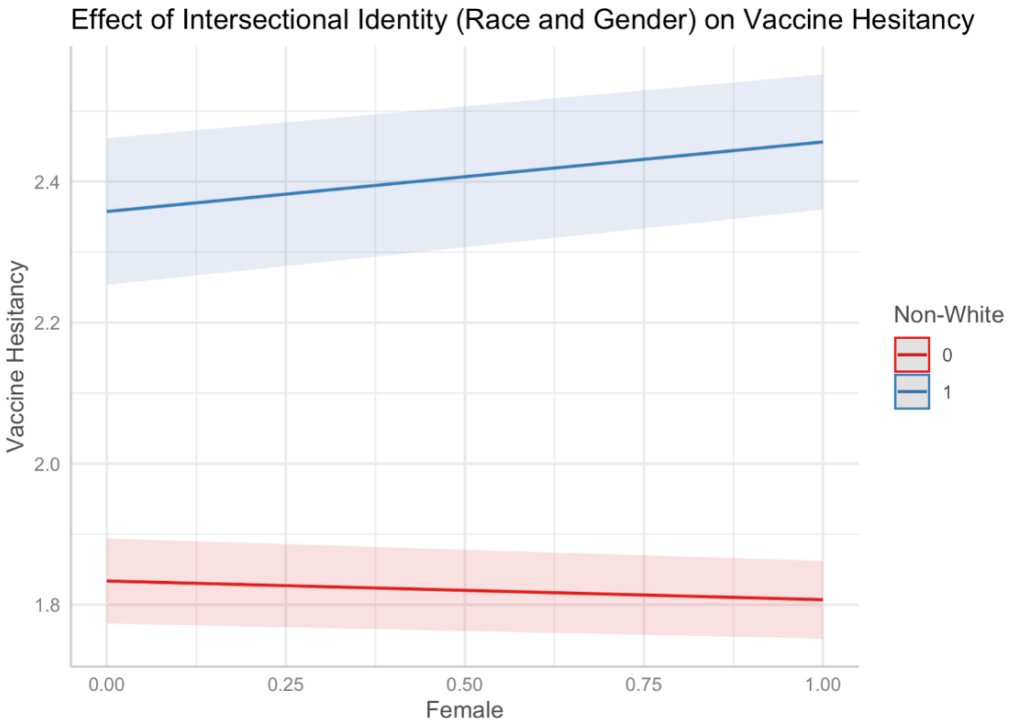
The results of the regression model do not show sufficient evidence that an intersectional identity for Black and Asian women affects attitudes towards vaccines. Interestingly, my results suggest that being female is negatively related to vaccine hesitancy, which is not the consensus in the literature. Similarly, my results suggest that watching Fox News makes people less vaccine-hesitant, which is a surprising result. As is illustrated in my prediction plots, there is an observed difference in vaccine hesitancy for men and women based on race. Being a Black woman is associated with less vaccine hesitancy, while being an Asian woman is associated with more. Based on my regression, I will not reject the null hypotheses that being female, Asian, female and non-white, or female and Black does not affect vaccine hesitancy. I will reject the null hypotheses that being non-white, being Black, or being female and Asian does not affect vaccine hesitancy.

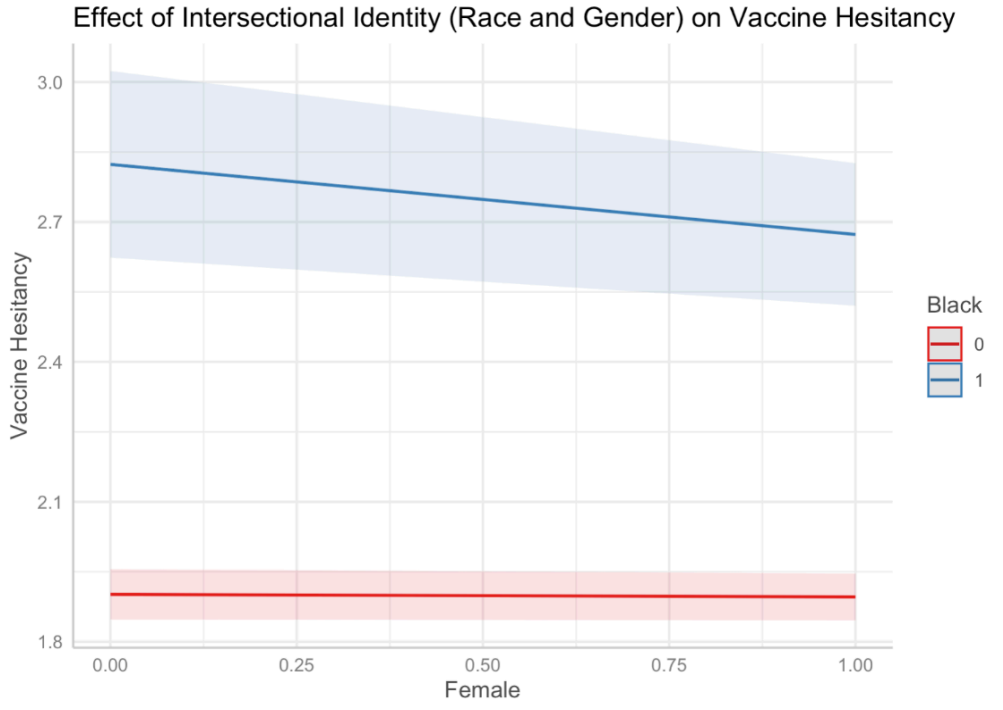
Model 1:

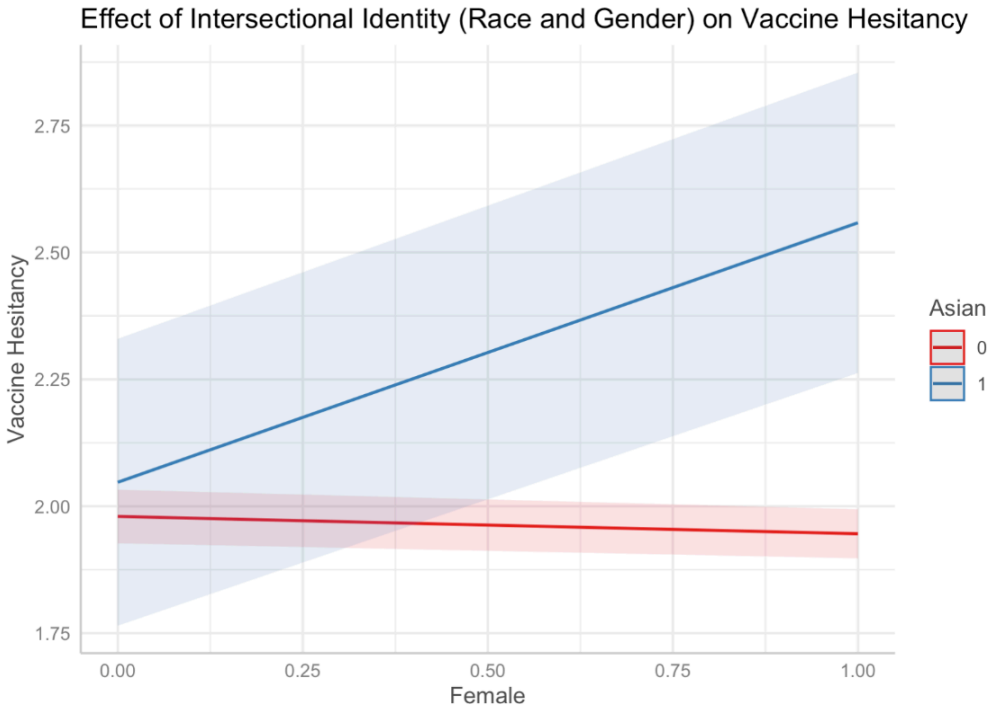
	Dependent variable:	
	Vaccine Hesitancy	
	(1)	(2)
Female	-0.027	0.005
	(0.041)	(0.036)
Non-white	0.524***	0.592***
	(0.062)	(0.043)
Income	-0.026***	-0.026***
	(0.003)	(0.003)
Education	-0.169***	-0.169***
	(0.018)	(0.018)
Conspiracy Thinking	0.205***	0.205***
	(0.016)	(0.016)
Republican	0.057***	0.057***
	(0.009)	(0.009)
Watches Fox News programs	-0.079*	-0.077
	(0.048)	(0.048)
Female and Non-white	0.126	
	(0.082)	
Constant	2.037***	2.022***
	(0.067)	(0.067)
Observations	5,234	5,234
R^2	0.157	0.156
Adjusted R^2	0.155	0.155
Residual Std. Error	1.279 (df = 5225)	1.279 (df = 5226)
F Statistic	121.250*** (df = 8; 5225)	138.198*** (df = 7; 5226)
Note:		*p<0.1; **p<0.05; ***p<0.01

Model 2:

	Dependent variable:	
	Vaccine Hesitancy	
	(1)	(2)
Female	-0.022	-0.017
	(0.038)	(0.036)
Black	0.922***	0.828***
	(0.106)	(0.066)
Income	-0.026***	-0.026***
	(0.003)	(0.003)
Education	-0.173***	-0.174***
	(0.018)	(0.018)
Conspiracy Thinking	0.210***	0.210***
	(0.016)	(0.016)
Republican	0.056***	0.056***
	(0.009)	(0.009)
Watches Fox News programs	-0.095**	-0.095**
	(0.048)	(0.048)
Asian	0.067	0.327***
	(0.146)	(0.106)
Female and Black	-0.145	
	(0.131)	
Female and Asian	0.545***	
	(0.211)	
Constant	2.117***	2.115***
	(0.066)	(0.066)
Observations	5,234	5,234
R^2	0.153	0.151
Adjusted R^2	0.151	0.150
Residual Std. Error	1.282 (df = 5223)	1.283 (df = 5225)
F Statistic	94.065*** (df = 10; 5223)	116.415*** (df = 8; 5225)


Effect of Intersectional Identity (Race and Gender) on Vaccine Hesitancy
Vaccine Hesitancy
2.4
2.2
2.0
1.8
0.00
0.25
0.50
0.75
1.00
Female
Non-White
0
1


Effect of Intersectional Identity (Race and Gender) on Vaccine Hesitancy
Vaccine Hesitancy
3.0
2.7
2.4
2.1
1.8
0.00
0.25
0.50
0.75
1.00
Female
Black
0
1



VI. Discussion

My findings point to race as more of a contributing factor to vaccine attitudes than gender, although the results are nuanced. I find that the impacts of an intersectional identity for women of color are mixed. Black women have a negative association with vaccine hesitancy, while Asian women, and women of color in general, have a positive association. This means that in the endeavor of encouraging people to get the vaccine, approaches should take into consideration race-based discrepancies in vaccine attitudes in order to design effective measures.

The discrepancy between Asian and Black women may be due to the result that being female is negatively associated with vaccine hesitancy, which contrasts the general consensus in the literature, as well as the theory. I think that the statistically insignificant or counterintuitive results are primarily a result of insufficient theory, although I think the data is part of the problem as well. Only 8.8% of the respondents were Black, and only 3.5% of respondents were Asian or

Native Hawaiian/other Pacific Islander. This does not line up with the racial makeup of the US. Black people make up 12% of the US population, and Asian people make up 5.75% (Data USA). Additionally, the data does not allow for distinction between Asian respondents and Native Hawaiian/other Pacific Islander. Due to the mixed results for Asian and Black women, more research is warranted on specific intersectional identities for different groups of women.

Due to differing stereotypes across race, it is logical that experiences of discrimination would not be uniform across all women of color. Women of color experience different forms of medical discrimination. For example, Latina women have experienced medical discrimination due to immigration status, and Middle Eastern women report increased racism through the perpetuation of stereotypes in a medical setting after the Muslim ban (Nguyen et al. 2023). Since women of color face different challenges in the medical system, any attempt to decrease vaccine hesitancy through the building of medical trust must take these differences into account. The findings of this paper suggest that a blanket approach would not work. Future interventions and research should account for the various forms of discrimination faced by each group, rather than applying a uniform solution.

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Appendix

Diagnostic Tests for Regression Assumption Violations:

Model 1:

Multicollinearity:

```
> vif(model1, type = "predictor")
 GVIFs computed for predictors
                 GVIF Df GVIF^(1/(2*Df)) Interacts With
female_20     1.133441  3        1.021096    nonwhite_20
nonwhite_20   1.133441  3        1.021096      female_20
income_20     1.213117  1        1.101416              --
edu_20        1.209449  1        1.099750              --
conspiracy_20 1.299714  1        1.140050              --
republican    1.467615  1        1.211452              --
fox           1.244242  1        1.115456              --
                                                                Other Predictors
female_20                         income_20, edu_20, conspiracy_20, republican, fox
nonwhite_20                       income_20, edu_20, conspiracy_20, republican, fox
income_20           female_20, nonwhite_20, edu_20, conspiracy_20, republican, fox
edu_20            female_20, nonwhite_20, income_20, conspiracy_20, republican, fox
conspiracy_20           female_20, nonwhite_20, income_20, edu_20, republican, fox
republican            female_20, nonwhite_20, income_20, edu_20, conspiracy_20, fox
fox           female_20, nonwhite_20, income_20, edu_20, conspiracy_20, republican
```

Heteroskedasticity:

```
> bptest(model1)

        studentized Breusch-Pagan test

data:  model1
BP = 385.45, df = 8, p-value < 2.2e-16
```

```
> robust_se_1 <- vcovHC(model1, type = "HC1")
> robust_se_1
                       (Intercept)     female_20   nonwhite_20     income_20        edu_20 conspiracy_20
(Intercept)           4.741562e-03 -9.093591e-04 -1.031493e-03 -6.965149e-05 -7.803185e-04 -4.275803e-04
female_20            -9.093591e-04  1.502895e-03  8.413186e-04  4.182754e-06  8.798466e-07 -4.328558e-05
nonwhite_20          -1.031493e-03  8.413186e-04  4.464444e-03  4.188471e-06  5.426703e-05 -8.254895e-05
income_20            -6.965149e-05  4.182754e-06  4.188471e-06  9.022523e-06 -1.919509e-05  7.967019e-06
edu_20               -7.803185e-04  8.798466e-07  5.426703e-05 -1.919509e-05  3.306880e-04  5.048780e-05
conspiracy_20        -4.275803e-04 -4.328558e-05 -8.254895e-05  7.967019e-06  5.048780e-05  3.027816e-04
republican           -1.446154e-04  2.315386e-05  4.465340e-05 -2.726777e-06  1.949260e-05 -5.913557e-05
fox                   1.307834e-04  1.402516e-04  8.994803e-05 -4.363770e-06 -9.397068e-06 -1.291160e-04
female_20:nonwhite_20 6.497859e-04 -1.474394e-03 -4.402617e-03  4.155836e-06  2.048277e-05 -1.404863e-05
                        republican           fox female_20:nonwhite_20
(Intercept)          -1.446154e-04  1.307834e-04          6.497859e-04
female_20             2.315386e-05  1.402516e-04         -1.474394e-03
nonwhite_20           4.465340e-05  8.994803e-05         -4.402617e-03
income_20            -2.726777e-06 -4.363770e-06          4.155836e-06
edu_20                1.949260e-05 -9.397068e-06          2.048277e-05
conspiracy_20        -5.913557e-05 -1.291160e-04         -1.404863e-05
republican            8.864937e-05 -1.706072e-04          4.400341e-05
fox                  -1.706072e-04  2.719581e-03         -2.079034e-04
female_20:nonwhite_20 4.400341e-05 -2.079034e-04          8.245525e-03
> coeftest_result_1 <- coeftest(model1, vcov. = robust_se_1)
```

```
stargazer(model1, coeftest_result_1, type = 'html', out = "model1reg.html", covariate.labels = c("Female"
,"Non-white","Income","Education","Conspiracy Thinking","Republican","Watches Fox News programs","Female
and Non-white"), dep.var.labels = "Vaccine Hesitancy")
browseURL("model1reg.html")
```

	Dependent variable:	
	Vaccine Hesitancy	
	OLS	*coefficient test*
	(1)	(2)
Female	-0.027	-0.027
	(0.041)	(0.039)
Non-white	0.524***	0.524***
	(0.062)	(0.067)
Income	-0.026***	-0.026***
	(0.003)	(0.003)
Education	-0.169***	-0.169***
	(0.018)	(0.018)
Conspiracy Thinking	0.205***	0.205***
	(0.016)	(0.017)
Republican	0.057***	0.057***
	(0.009)	(0.009)
Watches Fox News programs	-0.079*	-0.079
	(0.048)	(0.052)
Female and Non-white	0.126	0.126
	(0.082)	(0.091)
Constant	2.037***	2.037***
	(0.067)	(0.069)
Observations	5,234	
R^2	0.157	
Adjusted R^2	0.155	
Residual Std. Error	1.279 (df = 5225)	
F Statistic	121.250*** (df = 8; 5225)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

Autocorrelation:

```
> bgtest(model1)

        Breusch-Godfrey test for serial correlation of order up to 1

data:  model1
LM test = 2.1974, df = 1, p-value = 0.1382
```

Endogeneity:

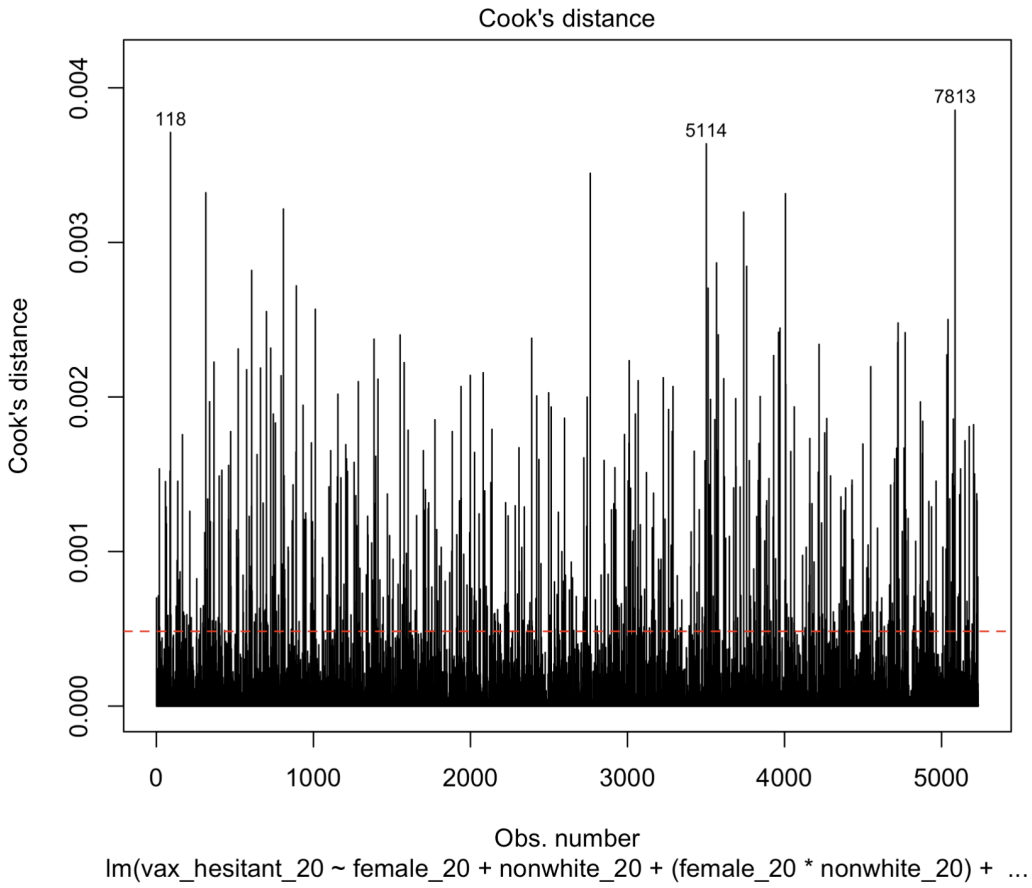
```
> resettest(model1)

        RESET test

data:  model1
RESET = 8.8419, df1 = 2, df2 = 5223, p-value = 0.0001467
```

Influential Data Points:

```
cooks.distance(model1)
cutoff_1 <- 4/(8280-8-1)
plot(model1, which=4, cook.levels = cutoff_1)
abline(h=cutoff_1,lty=2,col="red")
```



Model 2:

Multicollinearity:

```
> vif(model2, type = "predictor")
 GVIFs computed for predictors
                 GVIF Df GVIF^(1/(2*Df)) Interacts With
female_20    1.148599  5        1.013951   black, asian
black        1.177013  3        1.027536      female_20
income_20    1.218960  1        1.104065             --
edu_20       1.212261  1        1.101027             --
conspiracy_20 1.296123  1        1.138474             --
republican   1.479882  1        1.216504             --
fox          1.245635  1        1.116080             --
asian        1.137442  3        1.021696      female_20
                                                                Other Predictors
female_20                            income_20, edu_20, conspiracy_20, republican, fox
black                       income_20, edu_20, conspiracy_20, republican, fox, asian
income_20             female_20, black, edu_20, conspiracy_20, republican, fox, asian
edu_20              female_20, black, income_20, conspiracy_20, republican, fox, asian
conspiracy_20             female_20, black, income_20, edu_20, republican, fox, asian
republican              female_20, black, income_20, edu_20, conspiracy_20, fox, asian
fox              female_20, black, income_20, edu_20, conspiracy_20, republican, asian
asian                       black, income_20, edu_20, conspiracy_20, republican, fox
>
```

Heteroskedasticity:

```
> bptest(model2)

        studentized Breusch-Pagan test

data:  model2
BP = 351.44, df = 10, p-value < 2.2e-16
```

```
> robust_se_2 <- vcovHC(model2, type = "HC1")
> robust_se_2
                  (Intercept)     female_20         black     income_20        edu_20 conspiracy_20
(Intercept)      4.660660e-03 -8.318248e-04 -1.419216e-03 -7.225282e-05 -7.737082e-04 -4.373436e-04
female_20       -8.318248e-04  1.386648e-03  8.252928e-04  5.926799e-06 -5.647685e-06 -4.564171e-05
black           -1.419216e-03  8.252928e-04  1.689801e-02  2.273400e-05  1.131411e-04 -1.978036e-04
income_20       -7.225282e-05  5.926799e-06  2.273400e-05  9.092375e-06 -1.899779e-05  7.758348e-06
edu_20          -7.737082e-04 -5.647685e-06  1.131411e-04 -1.899779e-05  3.319128e-04  5.436045e-05
conspiracy_20   -4.373436e-04 -4.564171e-05 -1.978036e-04  7.758348e-06  5.436045e-05  3.040675e-04
republican      -1.440581e-04  2.524622e-05  1.493311e-04 -2.446790e-06  1.752568e-05 -6.060862e-05
fox              1.465857e-04  1.233628e-04 -4.698347e-05 -5.056579e-06 -6.913215e-06 -1.277229e-04
asian           -2.137798e-04  7.576932e-04  7.421758e-04 -1.179351e-05 -1.278473e-04 -1.311998e-04
female_20:black  8.501258e-04 -1.386126e-03 -1.652562e-02 -4.525058e-06 -3.757872e-05  4.206066e-05
female_20:asian  5.356981e-04 -1.369696e-03 -6.825238e-04 -1.630664e-05  1.206975e-04  3.385328e-06
                   republican           fox         asian female_20:black female_20:asian
(Intercept)     -1.440581e-04  1.465857e-04 -2.137798e-04    8.501258e-04    5.356981e-04
female_20        2.524622e-05  1.233628e-04  7.576932e-04   -1.386126e-03   -1.369696e-03
black            1.493311e-04 -4.698347e-05  7.421758e-04   -1.652562e-02   -6.825238e-04
income_20       -2.446790e-06 -5.056579e-06 -1.179351e-05   -4.525058e-06   -1.630664e-05
edu_20           1.752568e-05 -6.913215e-06 -1.278473e-04   -3.757872e-05    1.206975e-04
conspiracy_20   -6.060862e-05 -1.277229e-04 -1.311998e-04    4.206066e-05    3.385328e-06
republican       9.064122e-05 -1.744415e-04  4.707792e-05   -3.387855e-07    4.244015e-05
fox             -1.744415e-04  2.735309e-03  1.865980e-04   -1.851332e-04   -1.424670e-04
asian            4.707792e-05  1.865980e-04  1.485753e-02   -7.298632e-04   -1.471971e-02
female_20:black -3.387855e-07 -1.851332e-04 -7.298632e-04    2.511049e-02    1.360298e-03
female_20:asian  4.244015e-05 -1.424670e-04 -1.471971e-02    1.360298e-03    4.726745e-02
> coeftest_result_2 <- coeftest(model2, vcov. = robust_se_2)
```

```
stargazer(model2, coeftest_result_2, type = 'html', out = "model2reg.html", covariate.labels = c("Female"
,"Black","Income","Education","Conspiracy Thinking","Republican","Watches Fox News programs","Asian"
,"Female and Black","Female and Asian"), dep.var.labels = "Vaccine Hesitancy")
browseURL("model2reg.html")
```

	Dependent variable:	
	Vaccine Hesitancy	
	OLS	*coefficient test*
	(1)	(2)
Female	-0.022	-0.022
	(0.038)	(0.037)
Black	0.922***	0.922***
	(0.106)	(0.130)
Income	-0.026***	-0.026***
	(0.003)	(0.003)
Education	-0.173***	-0.173***
	(0.018)	(0.018)
Conspiracy Thinking	0.210***	0.210***
	(0.016)	(0.017)
Republican	0.056***	0.056***
	(0.009)	(0.010)
Watches Fox News programs	-0.095**	-0.095*
	(0.048)	(0.052)
Asian	0.067	0.067
	(0.146)	(0.122)
Female and Black	-0.145	-0.145
	(0.131)	(0.158)
Female and Asian	0.545***	0.545**
	(0.211)	(0.217)
Constant	2.117***	2.117***
	(0.066)	(0.068)
Observations	5,234	
R^2	0.153	
Adjusted R^2	0.151	
Residual Std. Error	1.282 (df = 5223)	
F Statistic	94.065*** (df = 10; 5223)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

Autocorrelation:

```
> bgtest(model2)

        Breusch-Godfrey test for serial correlation of order up to 1

data:  model2
LM test = 1.899, df = 1, p-value = 0.1682
```

Endogeneity:

```
> resettest(model2)

        RESET test

data:  model2
RESET = 2.7935, df1 = 2, df2 = 5221, p-value = 0.0613
```

Influential Data Points:

```
cooks.distance(model2)
cutoff <- 4/(8280-10-1)
plot(model2, which=4, cook.levels = cutoff)
abline(h=cutoff,lty=2,col="red")
```