



COVID-19 Vaccination Intake and Intention Among Black and White Residents in Southeast Michigan

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Abstract

Using the “3Cs” vaccine hesitancy framework which categorizes determinants of vaccine hesitancy across three dimensions—confidence, complacency, and convenience—we identify factors that shape COVID-19 vaccination intake and intention among Black and white residents in Southeast Michigan. We consider both historical discrimination in medicine and contemporary health and environmental crises (i.e., the Flint Water Crisis) as potential correlates. This study uses data from an online survey conducted between March–April 2021 in Flint and surrounding counties. We find that while historical mistreatment of Black people in healthcare and the Flint Water Crisis were of concern, those factors did not directly impact vaccination intention. Rather, concerns over safety, efficacy, and structural barriers related to access and occupation emerge as responsible for lower vaccination rates among Black residents. Effective vaccination programs require that public health authorities consider multiple factors, including the structural realities faced by racial ethnic minority groups which shape their vaccination decisions.

Keywords COVID-19 · Vaccine hesitancy · Michigan · Race · Flint · Flint Water Crisis

Background

In early April 2021, the state of Michigan had the worst COVID-19 outbreak in the United States [1]. At one juncture, the state accounted for over 10% of cases in the entire country including 9 of 10 metro areas with the worst COVID-19 outbreaks [2]. Southeast Michigan was among the geographic regions most responsible for driving the state’s overall COVID-19 numbers [1].

With the development and wide availability of COVID-19 vaccines, public health authorities have placed much emphasis on vaccination as a means of controlling the pandemic. Experts presume that around 70% of the population would need to be immune to achieve herd immunity [3]. In early May 2021, the Biden Administration set a goal of 70% of adults receiving at least one shot by July 2021. However, this goal remains elusive in many parts of the country. At the time of writing—August 25, 2021, the Michigan Department of Health and Human Services (MDHHS) reported that 55.3% of Michigan residents have been fully vaccinated [2], well below the national vaccination goal. This trend is reflected throughout counties in Southeast Michigan, including Genesee (48.7%), Macomb (55.2%), and Wayne (61.9%) [2].

The lower than anticipated vaccination rates in Southeast Michigan, particularly among Black residents is an important question for public health authorities. An often-cited cause behind the relatively lower vaccination rates is ‘vaccine hesitancy’ which the SAGE Working Group defines as a delay in acceptance or refusal of vaccines despite their availability [4]. Vaccine hesitancy is an outcome of the decision-making process and reflects various factors that may

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influence the decision to accept one, some, or all vaccines, in accordance with the recommended schedule [5].

It has been suggested that Black COVID-19 vaccine hesitancy may be an outcome of historical mistreatment in the medical care system [6]. Occurrences such as forced gynecological experiments on enslaved women, forced sterilization, and most notably the Tuskegee syphilis experiment, have resulted in distrust toward health authorities and scientific institutions today. However, it is important to evaluate additional factors that may be overlooked yet shape how people make vaccination decisions. Further, considering local factors can provide deeper context with which to inform vaccine administration and delivery [7].

In the case of Southeast Michigan, the ‘Flint Water Crisis’ could provide valuable contextual insights on vaccination decisions. The Flint Water Crisis is likely the most significant contemporary human-caused disaster to have occurred in Michigan. The decision in 2014 to switch Flint, a majority-minority city, to an alternative water source, resulted in approximately 100,000 residents being exposed to lead and other contaminants in their water supply. Over a protracted length of time, officials not only failed to appropriately treat the water but also dismissed residents’ complaints about the water quality. Eventually the city was switched back to its original water source and the compromised city pipe infrastructure was replaced. However, widespread distrust regarding elected officials and regulators remains [8]. It is plausible that this distrust extends to public health officials and the COVID-19 vaccines that they promote.

Theoretical Framework

This study utilizes aspects of the Confidence, Complacency, and Convenience (“3Cs”) model which groups the breadth of determinants of vaccine hesitancy. According to the SAGE Working Group, *confidence* is measured by trust in (1) the effectiveness and safety of vaccines, (2) the system that delivers them, including the reliability and competence of the health services and health professionals, and (3) the motivations of the policymakers who decide on the needed vaccines [5]. *Complacency* refers to where perceived risks of vaccine-preventable diseases are low, and vaccination is not deemed a necessary preventive action. Complacency is influenced by other life/health responsibilities that may be seen as more important at a given point in time [4]. *Convenience* refers to the extent to which physical availability, affordability, willingness-to-pay, geographical accessibility, ability to understand (e.g., language and health literacy), and appeal of immunization services, affect uptake. The quality of the service (real and/or perceived) and the degree to which vaccination services are delivered at a time and place and in a cultural context that is convenient and comfortable also affects the decision to be vaccinated [5].

We apply the 3Cs model to Southeast Michigan, taking into consideration historical mistreatment in medicine as well as significant local circumstances (i.e., Flint Water Crisis). Attitudes reflective of *confidence*, *convenience*, and *complacency* are assessed, along with how these attitudes are associated with vaccine intake and intention. By comparing Black residents in Southeast Michigan to white residents, who are the dominant racial group, the study provides insights on factors that shape COVID-19 vaccine hesitancy in the region and their racial variations.

Methods

Data Collection

Between March 22, 2021 and April 16, 2021 we conducted an online survey data collection via Qualtrics, a company specializing in aggregating data from online panels (N = 1025). Our survey, deemed exempt by the Institutional Review Board of the Central Michigan University, consisted of a series of questions related to the Flint Water Crisis, COVID-19, trust in institutions, health protective behavior, vaccination intake and intention, and information sources. Survey questions were developed based on concepts widely attributed to the health belief model, theory of planned behavior, and the social amplification of risk framework.

Survey responses came from Flint (n = 94) and Genesee country (n = 219), along with eight surrounding counties in Southeast Michigan: Lapeer (n = 20), Livingston (n = 27), Macomb (n = 156), Monroe (n = 44), Oakland (n = 274), Saint Claire (n = 29), Washtenaw (n = 69) and Wayne (n = 187). Our sample is representative of U.S. census data for gender (female = 50.2%). The mean age of the sample was 46.9 (SD = 17.78). Nearly 78% of the sample identified as white, 22% as Black, and 11% as other or mixed race. 46.6% of the sample are college graduates or higher, 30% have some college education, 20% has a high school diploma or GED, and 3.2% have not graduated high school. Majority considers themselves as politically moderate (44%) with 31% liberal and 25% conservative. Of the total sample, 19.2% have household incomes less than \$25,000, while 34% reported incomes exceeding \$75,000. 92% of respondents indicated that they have health insurance, while 35% of households have children under 18 years of age (Table 1).

Measures

Our survey asked respondents if they have received at least one dose of a COVID-19 vaccine at the time of the survey. This question constitutes our primary *vaccine intake* measure (See Figure SM1 in supplementary materials). For those who indicated that they have not yet received at least one dose, we

Table 1 Sociodemographic Characteristics

Characteristic	Full Sample; Mean (SD); % (Frequency) (N = 1025)
Gender	
Women	50.2% (515)
Men	49.2% (504)
Other	0.6% (6)
Political ideology	
Very Liberal	10.2% (105)
Liberal	21.0% (215)
Moderate	44.0% (451)
Conservative	16.4% (168)
Very Conservative	8.4% (86)
Age	46.9 (17.78)
Education	
Did Not Graduate High School	3.2% (33)
High School Diploma or Equivalent (GED)	20.0% (205)
Some College	30.1% (309)
College Graduate or Higher	46.6% (478)
Race	
Black	22.4% (205)
White	77.5% (710)
Other	10.7% (110)
Income	
Less than \$25,000	19.2% (197)
\$25,000—\$49,999	26.6% (273)
\$50,000—\$74,999	20.1% (206)
\$75,000 or More	34.0% (349)
Health Insurance Status	
Yes	91.6% (939)
No	8.4% (86)
Children < 18 present in the household	
Yes	34.5% (354)
No	65.5% (671)

provided a series of items measuring their *vaccination intention* on an ordinal scale, from high intention/low hesitancy to low intention/high hesitancy (1 = will get the vaccine as soon as I can; 2 = waiting to see how the vaccine works; 3 = will only get the vaccine if required; 4 = definitely will not get the vaccine) (See Figure SM2 in supplementary materials).

Further, for those who indicated that they have not yet received at least one dose, we provided a series of 18 survey items capturing their reasons for not doing so. Ten items represent *confidence* and 3 items each represent *convenience* and *complacency*, including items on the Flint Water Crisis. Two additional items (social influence and information seeking) do not directly reflect constructs in the 3Cs model but are considered important determinants of health behavior. All items were measured as dichotomous nominal variables where 0 = agree and 1 = disagree, representing our *vaccine attitudes* items (Table 2).

Analytical Strategies

To examine the differences of vaccine attitudes across Black and white subpopulations, we employed chi-square analysis. To test associations between vaccine attitudes and vaccination intention across the two groups we used chi-square analysis along with a test of association (gamma). Additionally, we used Spearman correlations to examine the magnitude and significance of correlations between vaccine attitudes across the two groups.

Results

At the time of data collection (March–April 2021) only 40% of Black respondents indicated that they had received at least one dose of a COVID-19 vaccine as opposed to 57%

Table 2 Vaccine Attitudes and Vaccination Intention by Race

Survey item	Vaccine attitudes			Vaccine attitudes BY vaccination intention	
	Black (% agree)	White (% agree)	Chi-square significance	Black Chi-square significance/ Gamma	White Chi-square significance/ Gamma
COVID-19 vaccine is safe (confidence 1)	31.7%	52.8%	p=0.00	p=0.00 $\gamma=0.75$	p=0.00 $\gamma=0.85$
COVID-19 vaccine is effective (confidence 2)	41.5%	52.8%	p=0.03	p=0.00 $\gamma=0.64$	p=0.00 $\gamma=0.86$
I can get COVID-19 from the vaccine (confidence 3)	48.0%	33.4%	p=0.005	ns	p=0.00 $\gamma=-0.41$
The vaccines were developed and tested too quickly (confidence 4)	66.7%	66.9%	ns	ns	p=0.00 $\gamma=-0.55$
I have personally experienced mistreatment in the medical care system in the past (confidence 5)	26.8%	25.6%	ns	ns	ns
I have personally experienced racism in the medical care system in the past (confidence 6)	34.1%	13.1%	p=0.00	ns	ns
Historical mistreatment of Black people in the medical care system makes me concerned about the vaccine (confidence 7)	55.3%	18.4%	p=0.00	ns	ns
It's hard to know whom to trust when it comes to COVID-19 vaccine information (confidence 8)	63.4%	60.0%	ns	ns	p=0.00 $\gamma=-0.37$
It's hard to trust what public health officials say about the vaccine because of what happened with Flint water (confidence 9)	65.9%	54.4%	p=0.03	ns	p=0.006 $\gamma=-0.22$
Public health officials lied during the Flint Water Crisis and are likely to lie again about the vaccine (confidence 10)	69.9%	56.4%	p=0.01	ns	p=0.00 $\gamma=-0.39$
I don't know where to sign up for a vaccine (convenience 1)	22.8%	24.3%	ns	ns	ns
It will be difficult to travel to a vaccination site (convenience 2)	25.2%	17.4%	ns	p=0.02 $\gamma=0.37$	ns
I don't have health insurance to pay for the vaccine (convenience 3)	22.0%	17.7%	ns	ns	ns
I am worried about taking time off from work to get the vaccine (complacency 1)	22.0%	11.1%	p=0.004	p=0.04 $\gamma=0.36$	ns
I am worried about missing work if the side effects make me sick (complacency 2)	41.5%	30.2%	p=0.02	ns	ns
I fear needles (complacency 3)	29.3%	24.9%	ns	ns	ns
My family and friends don't plan to get the vaccine (social influence)	35.0%	35.1%	ns	ns	p=0.00 $\gamma=-0.50$
I want more information about the vaccine before I get vaccinated (information)	58.5%	61.0%	ns	p=0.04 $\gamma=0.07$	p=0.00 $\gamma=-0.10$

ns = not significant at $p < 0.05$

of white respondents ($p < 0.001$) (Figure SM1). Significant differences existed between Black and white sub-populations on vaccination intention: while approximately 30% of white respondents indicated that they will get the vaccine 'as soon as possible,' only 16% of Black respondents agreed. More Black respondents than white respondents indicated that they will 'wait and see' how the vaccine works (32% vs 25%) and they will 'get it only if required' (20% vs 17%). Overall,

survey data indicate a statistically significant difference in vaccination intention between Black and white groups as seen by the high levels of hesitancy among Black respondents compared to their white counterparts ($p < 0.001$) (Figure SM2).

Table 2 shows percentage distributions across Black and white sub-populations on vaccine attitudes as well as the associations between vaccine attitudes and vaccination

intention, focusing on those who had not received at least one dose of a vaccine at the time of survey. Among these unvaccinated individuals, statistically significant differences exist between Black and white groups in their attitudes toward whether the vaccine is safe (32% Black vs 53% white; $p < 0.001$) and effective (42% Black vs 53% white; $p < 0.05$). A higher percentage of unvaccinated Black than white respondents believe that one can get COVID-19 from the vaccine (48% Black vs 33% white; $p < 0.01$). Notably, a significantly higher percentage of Black respondents agreed that historical mistreatment of Black people in the medical system makes them concerned about the vaccine (55% Black vs 18% white; $p < 0.001$).

Trust in vaccine information and messengers seems to be a concern as well. Over 60% of both Black and white respondents indicated that it is ‘hard to know whom to trust’ when it comes to COVID-19 vaccine information. In particular, concerns about trust seem to be shaped by contemporary crises. For example, a higher percentage of Black respondents agreed that ‘it’s hard to trust what public health officials say about the vaccine because of what happened with Flint water’ (66% Black vs 54% white; $p < 0.05$), suggesting this crisis may have caused long-term damage to expert-public relations on matters of public health.

On *convenience*, we did not observe any significant differences. However, across both groups, approximately 17–25% of respondents indicated that lack of access poses a barrier to vaccination. Specifically, not knowing ‘where to sign up for a vaccine,’ difficulty of travelling to vaccination sites, and lack of ‘health insurance to pay for vaccines’ seems to be preventing people from obtaining the vaccine. It is worth noting that the COVID-19 vaccine is available freely for anyone over 12 years of age in the US regardless of insurance status. That 22% Black and 18% white respondents believe they need health insurance to obtain the vaccine indicates a lack of accurate information in the counties in which our survey was conducted and at that time. This is reaffirmed by 58% Black and 61% white respondents who agreed they ‘need more information about the vaccines.’

On *complacency*, we uncovered a few notable differences. More unvaccinated Black than unvaccinated white respondents indicated that they are ‘worried about taking time off from work to get the vaccine’ (22% Black vs 11% white; $p < 0.01$) and that they are ‘worried about missing work’ if the side effects make them sick (42% Black vs 30% white; $p < 0.05$). Lastly, on our social influence measure, roughly 35% of both Black and white unvaccinated respondents indicated that their family and friends do not plan to get vaccinated.

Correlation analysis of vaccine attitudes among unvaccinated Black and white sub-groups reveal interesting nuances. For unvaccinated white respondents, perceptions of safety are highly and significantly associated with perceptions of efficacy (Spearman’s correlation = 0.80; $p < 0.01$). However, the

magnitude of this correlation is lower for Black respondents (Spearman’s correlation = 0.49; $p < 0.01$). For the Black sub-group there is a higher correlation between agreeing that it is hard to trust public health officials because of what happened with Flint water and agreeing that it is generally hard to know whom to trust when it comes to COVID-19 vaccine information (Spearman’s correlation = 0.73; $p < 0.01$). Though significant, this association is lower for their white counterparts (Spearman’s correlation = 0.46; $p < 0.01$). Additionally, there is a significant and higher correlation between wanting more vaccine information and knowing whom to trust when it comes to such information among Black respondents (Spearman’s correlation = 0.63; $p < 0.01$) than white respondents (Spearman’s correlation = 0.47; $p < 0.01$). (See Tables SM1 and SM2 in supplementary materials for correlation matrices of vaccine attitudes.)

We further examined how specific vaccine attitudes are associated with vaccination intention across the two groups. As seen in Table 2, for both Black and white sub-groups, the vaccine attitudes mostly closely associated with vaccination intention are concerns about safety ($\gamma = 0.75$ Black vs $\gamma = 0.85$ white) and efficacy ($\gamma = 0.64$ Black vs $\gamma = 0.86$ white). Among the unvaccinated, those who believe vaccines to be safe and effective are less hesitant to obtain the vaccine.

Among whites, believing that vaccines can cause COVID-19 or vaccines were developed too quickly increases vaccine hesitancy, although these attitudes are not significantly associated with vaccination intention for the Black sub-group. Neither group indicated personal experiences of mistreatment, historical mistreatment, or racism has affected their current vaccination decisions.

Perceived barriers and access seem to affect vaccination intention among the unvaccinated Black group more than the unvaccinated white group. The likelihood of vaccination is lower for Black respondents who are ‘worried about taking time off from work to get the vaccine’ and those who find it ‘difficult to travel to a vaccination site’ ($\gamma = 0.36$ and 0.37 respectively). Among white respondents, those who say their ‘family and friends don’t plan to get the vaccine’ have lower vaccination intentions ($\gamma = -0.50$) although this association is not statistically significant for Black respondents. Lastly, while the Black sub-group reported lower trust in public health officials due to the Flint Water Crisis, this distrust is not associated with their vaccination intention. However, distrust leads to lower vaccination intentions for the white sub-group (See confidence items 8–10 in Table 2).

Discussion

To understand COVID-19 vaccine hesitancy among Black residents in Southeast Michigan, we evaluated a number of potential contributing factors in accordance with the 3Cs

model. While much attention has been paid to historical traumas such as the Tuskegee syphilis experiment in creating vaccine hesitancy among Black people [6], we complicate this prevailing thinking (i) by identifying other factors likely to shape vaccination decisions and (ii) by deciphering if the Flint Water Crisis, a significant part of the local context, shapes decisions about vaccines.

Our findings suggest that racism causes vaccine hesitancy among Black people in ways not necessarily reflected in the dominant narrative. Egregious historical racial mistreatment (e.g., the Tuskegee experiment) as well as experiences with interpersonal racism (i.e., racism between individuals) in the medical care system were likely on the minds of unvaccinated Black residents. The Flint Water Crisis too, was on the minds of respondents in Southeast Michigan. However, Black respondents indicated that those considerations ultimately did not directly affect their vaccination decisions. Instead, we see structural racism having a larger effect on Black residents' vaccination decisions. Structural racism refers to the laws, norms, or policies that create and sustain advantages and disadvantages based on race. Though not necessarily easily identifiable, this dimension of racism which frequently has historical roots is likely ultimately behind vaccine hesitancy among Black people in Southeast Michigan. This finding, which we elaborate below, is an important reminder to the research community that assumptions about what drives Black vaccine hesitancy should be constantly and rigorously evaluated by asking the communities that are directly affected.

Among factors that relate to vaccine *confidence*, not surprisingly, unvaccinated Black respondents were far more likely to indicate that they had personally experienced racism in the medical care system in the past. Over half of white respondents agreed that COVID-19 vaccine was both safe and effective. Black respondents were far less likely to agree with this. What may be surprising to some, is that personal experience with racism appears to not directly inform vaccination decisions of Black people. The only *confidence* factors that surround the decision to get the shot are attitudes on vaccination safety and efficacy.

We evaluated a number of other factors, some of which reflect significant local realities such as the Flint Water Crisis. We found evidence that the Flint Water Crisis has impacted trust, a key component of vaccine *confidence*. Beyond the borders of Flint and even Genesee County, the majority of both Black and white respondents indicated that it is 'hard to trust what public health officials say about the vaccine because of what happened with Flint water' and that 'public health officials lied during the Flint Water Crisis and are likely to lie again about the vaccine.' Agreement with these sentiments was higher among Black residents.

There are a few plausible reasons why the Flint Water Crisis more severely damaged Black people's trust in public

health officials. First, though white people were affected too, given that Flint is a minority-majority city, African Americans were disproportionately affected. Second, officials not only exercised questionable judgement throughout the crisis, but they also dismissed residents' concerns about the water quality. Third, residents were told that the water was safe to drink when in fact, state and city officials knew that it was not [9]. In the aftermath of the water crisis, the director of the Michigan Department of Health and Human Services (MDHHS)—the top Michigan health official, was charged with a felony count of misconduct in office.

However, consistent with a number of above-mentioned *confidence* factors (e.g., historical/racist treatment), while the water crisis was of significant concern among unvaccinated Black people *and* did affect their trust in public health messaging, ultimately it did not play a significant role in their decision to get vaccinated. Interestingly, damaged trust resulting from the Flint Water Crisis did impact white residents' vaccination decisions.

Overall results suggest that historical mistreatment of Black people in the medical care system, *perceived* personal racist mistreatment by medical institutions, and contemporary crises such as the Flint Water Crisis, are not the primary drivers of vaccine hesitancy among Black residents in Southeast Michigan. This is not to say that racism does not play any role in Black vaccine hesitancy. It is arguable that African Americans have been conditioned to make many decisions while under sustained systematic mistreatment and exclusion. For them, racism is a "normal" part of how society is run. In contrast, because of their collective privilege, white respondents may be more singularly affected by events like the Flint Water Crisis in ways that may cause them to be more skeptical of what public health authorities promote.

This study also considered the role of misinformation in vaccination decisions. We found that the belief that one could get COVID-19 from the vaccine occurred across race. At the time of the survey, this was far more evident among Black residents, with nearly half subscribing to this belief. Public health authorities are rightly concerned with how disruptive misinformation can be in harming vaccination efforts. Among white respondents, this misperception did play a role in the decision to get the vaccine. However, though many unvaccinated Black people carried this belief, it was not associated with their intention of getting the COVID-19 shot.

Factors relating to vaccine *convenience* were also evaluated. One quarter of Black respondents indicated that it was difficult to travel to a vaccination site. This finding is validated by prior research that shows that Black people are less likely than white people to live near a pharmacy, clinic, hospital, or health center that can administer vaccines [10]. Research also shows that transportation inequities exist for communities of color [11]. This may be the case for Black

people in Southeast Michigan. Sustained and ongoing structural racism have created barriers to the extent that simply driving to a vaccination site is not a straightforward proposition for some.

We also considered how *complacency* about the vaccine was influenced by conflicting life/health responsibilities. Black people were more likely to be worried about taking time off from work to get the vaccine and about missing work due to any side effects. The ability to take time off from work seems to directly shape decisions. Generally, African Americans are overrepresented in occupations that are less stable and less flexible, particularly in the advent of deindustrialization and the more recent economic downturn due to the pandemic [12]. Given the stark choice between sustaining one's livelihood and getting the COVID-19 vaccine, many Black people in Southeast Michigan may have been forced to choose the former.

The findings of this study suggest that vaccine hesitancy is complex. Public health officials must consider a broad range of factors when putting together vaccine messaging, distribution, and administration plans. Concerns over safety and efficacy should be considered and addressed. Inequities in access and structural barriers at the regional/county level are implicated in this study and should be prioritized if the pandemic is to be controlled.

Extant research suggests that vaccine hesitancy is a fluid phenomenon that needs to be monitored over time [13]. The present study supports this assertion. Most people do seek more information about the vaccine before getting the shot. Dispelling misinformation about vaccines through effective, consistent messaging, must also be a priority for public health authorities. This affirms that messages promoting COVID-19 vaccination should seek to alleviate the concerns of those who are already vaccine-hesitant [14, 15].

This survey was conducted in a particular timeframe and findings must be understood within that context. Factors that shape vaccine decisions could change at a different point in the COVID-19 pandemic, such as the current phase of the pandemic where the Delta variant is spreading rapidly across communities, particularly in those with low vaccination rates. The factors we have investigated above are by no means exhaustive. Additionally, given our survey was conducted in Southeast Michigan with a non-probability sample recruited online, generalizability of results may be limited.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10903-022-01401-0>.

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