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Race-Related Stress, Medical Mistrust, COVID-19 Worry, and COVID-19 Vaccination Behavior Among African Americans

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Abstract

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MGA, University of Maryland University College, 1994

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

In the United States, nearly 104 million cases and over 1.1 million deaths from novel coronavirus disease of 2019 (COVID-19) have been reported overall, but African Americans have been disproportionately affected. Nevertheless, this population has demonstrated the lowest intention to be vaccinated and lowest vaccination rates of all racial/ethnic groups in the United States. The research problem addressed by this study is African American COVID-19 health disparities. The purpose of this investigation was to examine factors that influence COVID-19 vaccination behavior among African Americans, which is important to better understand how to achieve health equity. Using the health belief model and theory of planned behavior as the theoretical framework, this quantitative, cross-sectional, correlational study was conducted to examine the role that experiences of racism and concern about the disease play in whether and when African Americans decide to be vaccinated against COVID-19. Primary data were collected from 188 self-identified non-Hispanic African American adults via an online survey and were analyzed with logistic regression. No association between race-related stress, medical mistrust, COVID-19 worry, and vaccine hesitancy was found. Study results suggested the negative impact of experiences of racism and medical mistrust on African American COVID-19 vaccine uptake might be overcome by educational interventions. Culturally tailored public health programs should target not just race specific populations but differentiated within-race subgroups. Using these more refined approaches would lead to positive social change by promoting COVID-19 vaccine uptake among African Americans.

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Dedication

To the African Americans who continue to suffer the consequences of historical and contemporary racism, there are public health practitioners working towards evidence-based solutions to reduce your health disparities and improve your length and quality of life. To my sons, Noah, and Raphael, who have watched me toil over the years to get this done, I hope my example will show you that it's *never* too late to pursue your dreams. And last, but most importantly, to the Lord, thank You for the grace and strength to finish this race.

Acknowledgments

Dr. Robinson, I could not have asked for a better chair! Your probing questions challenged me, and your words of encouragement lifted me when I might otherwise have been tempted to give up. I am most grateful for your lesson that even what is "not significant" can make a meaningful contribution to the literature and for your charge to look beyond *p* values to find what the data ***are*** telling us. Dr. Kennedy, your guidance on the methodology and your subject matter expertise were invaluable to my success. To receive your affirmation that I had done a good job was an accolade I will cherish. And finally, I am grateful to Walden University, for providing an accredited online program that was rigorous yet flexible enough to accommodate my complex life. The school's emphasis on positive social change resonated strongly with me from day one and I am proud to be a product of Walden U!

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

The emergence of the novel coronavirus disease of 2019 (COVID-19) and the murder by police brutality of another unarmed Black man, this time in Minneapolis, conjoined to create a precarious atmosphere for African Americans. It was against this backdrop that public health officials struggled to mitigate the spread of COVID-19 in the United States, where African Americans have been disproportionately affected by the virus. The reasons for this disparity are copious and complex, but since the development of an effective vaccine against COVID-19 they include a hesitancy or refusal to be vaccinated among African Americans. Vaccination is one of the most effective public health strategies for managing infectious disease, and understanding the factors that contribute to a lack of COVID-19 vaccine uptake in this population is important to reduce the disparate burden of disease that contributes to health inequities in America.

In this chapter, I briefly summarize the literature related to African American COVID-19 vaccine hesitancy and uptake, identify the specific gap this study fills, and provide evidence for the importance and relevance of this research. The research questions and hypotheses that were tested are identified and the rationale for the study design is provided. Finally, I describe the scope, delimitations, and significance of this study.

Background

Since its emergence in China in December 2019, and in the United States a month later, COVID-19 has become a global pandemic. In the United States, nearly 104 million cases and over 1.1 million deaths from the disease have been reported overall (Centers for Disease Control and Prevention [CDC], 2023a). While current CDC (2023a) data show the

percentage of African American cases of COVID-19 (12.4%) approximately equals the percentage of African Americans in the U.S. population (12.5%), the Kaiser Family Foundation (KFF) reported that when data are adjusted to account for differences in age distribution by race/ethnicity, there are significant disparities in African American COVID-19 hospitalization and death rates as compared to White Americans (L. Hill & Artiga, 2022). African Americans are 1.1 times more likely to contract the disease, 2.1 times more likely to be hospitalized, and 1.6 times more likely to die from COVID-19 than their White counterparts (CDC, 2022c). While these numbers are down from the 2.6, 4.7, and 2.1 times of increased likelihood respectively reported in 2020 (Ellis et al., 2021), they still represent a gap that needs to be closed.

One reason for the disparities is the disproportionately high rate of comorbid chronic disease in the African American community at the time of the pandemic (Ferdinand et al., 2020; S. J. Kim & Bostwick, 2020; Savoia et al., 2021). This baseline state of compromised health makes African Americans more vulnerable to severe disease and death from COVID-19 (Ferdinand et al., 2020). The confluence of pre-existing comorbidities and decreased vaccine uptake has the potential to magnify the COVID-19 disease burden among African Americans and widen the racial disparities seen with this virus.

Inoculation against infectious diseases was one of the greatest public health achievements of the 20th century (CDC, 1999), and public health practitioners continue to support the critical role of vaccines in controlling infectious diseases (Fisher et al., 2020; Fisk, 2021; Orenstein & Ahmed, 2017). Even though African Americans are at greater risk for severe disease and death from COVID-19 (Asare et al., 2020; CDC, 2022c; Ellis et al.,

2021; L. Hill & Artiga, 2022), this population has demonstrated the lowest intention to be vaccinated (Khubchandani & Macias, 2021; Niño et al., 2021) and the lowest vaccination rates (Kriss et al., 2022; Ndugga et al., 2022; Rane et al., 2022; Siegel et al., 2021) of all racial/ethnic groups in America. COVID-19 vaccines have been shown to be both safe and effective (CDC, 2023b; U.S. Food and Drug Administration [FDA], 2023); however, the African American community has been wary of a vaccination made by a government that has not always had the best interests of this community at heart (Callaghan et al., 2021; Fisher et al., 2020; Kelly et al., 2020; Khubchandani & Macias, 2021). The vestiges of historical and contemporary acts of racism can be found in the racial stress and medical mistrust that is evident among many African Americans (Carter, 2007; Comas-Díaz, 2016; Johnson et al., 2021; A. C. Smith et al., 2021).

Problem Statement

The public health problem that inspired this research is African American COVID-19 health disparities. Data show racial disparities exist in COVID-19 (Asare et al., 2020; CDC, 2023a; L. Hill & Artiga, 2022), and unvaccinated individuals are at increased risk of infection, severe illness, and death from the disease (CDC, 2022e; Ndugga et al., 2022). This topic is relevant because public health practitioners have a responsibility to try to end this pandemic and mitigate the morbidity and mortality it causes. The first principle of the ethical practice of public health is to address "the fundamental causes of diseases and requirements for health, aiming to prevent adverse health outcomes" (Public Health Leadership Society, 2002, p. 4). Reducing morbidity and mortality are also foundational principles and overarching goals of Healthy People 2030—the national blueprint for the

current decade of public health (Office of Disease Prevention and Health Promotion [ODPHP], n.d.). Another goal of Healthy People 2030 is eliminating health disparities and achieving health equity (ODPHP, n.d.). Studying African American COVID-19 health disparities will help achieve these goals.

Healthy People 2030 also identifies racism as a social determinant of health (ODPHP, n.d.). Racism has also been associated with medical mistrust (Bazargan et al., 2021; Johnson et al., 2021), and both are contributing factors in African American health disparities (Benkert et al., 2019a; Carter et al., 2018; Institute of Medicine [IOM], 2003; Powell et al., 2019). African American medical mistrust is grounded in structural and interpersonal experiences of racism and discrimination, and medical mistrust has been identified as a barrier to acceptance of recommended health behaviors among African Americans (Bogart et al., 2021c; Johnson et al., 2021). It has also been associated with COVID-19 vaccine hesitancy (Bogart et al., 2021c; Johnson et al., 2021; Powell et al., 2019), and has been cited as a reason for low vaccination rates among African Americans (Bogart et al., 2021c; Ferdinand et al., 2020; Khubchandani & Macias, 2021; L. H. Nguyen et al., 2022). Despite studies on vaccine hesitancy, no published studies could be found on the intersectionality of the consequences of racism and COVID-19 vaccination behavior among African Americans. This study fills a gap in the literature by exploring the relationship between race-related stress, medical mistrust, COVID-19 worry and COVID-19 vaccination hesitancy and uptake among African Americans.

Purpose of the Study

The purpose of this quantitative investigation was to examine factors that influence

COVID-19 vaccination behavior among African Americans. The intent of this cross-sectional, correlational study was to examine the role that consequences of racism and concern about the disease play in whether and when African Americans decide to be vaccinated against COVID-19. The independent variables in this research were race-related stress, medical mistrust, and COVID-19 worry; the dependent variables were COVID-19 vaccine hesitancy and COVID-19 vaccine uptake; and the covariates were age, gender, education, and income.

Research Questions and Hypotheses

The research questions (RQ) and hypotheses (*H*) in this study were as follows.

RQ 1: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?

$H_0$1 = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.

$H_1$1 = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.

RQ 2: Is there a relationship between medical mistrust, measured by the Group

Based Medical Mistrust Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?

$H_0$2 = There is no relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.

$H_1$2 = There is a significant relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.

RQ 3: Is there a relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?

$H_0$3 = There is no relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.

$H_1$3 = There is a significant relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic

African American adults in the United States.

RQ 4: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?

$H_0 4_1$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.

$H_1 4_1$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.

$H_0 4_2$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional

delay, among self-identified non-Hispanic African American adults in the United States when controlling for age, gender, education, and income.

$H_1 4_2$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States when controlling for age, gender, education, and income.

RQ 5: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States?

$H_0 5$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.

$H_1 5$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.

RQ 6: Is there a relationship between medical mistrust, measured by the Group

Based Medical Mistrust Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States?

$H_0$6 = There is no relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.

$H_1$6 = There is a significant relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.

RQ 7: Is there a relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States?

$H_0$7 = There is no relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.

$H_1$7 = There is a significant relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.

RQ 8: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States?

$H_0 8_1$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.

$H_1 8_1$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.

$H_0 8_2$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States when controlling for age, gender, education, and income.

$H_1 8_2$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States when controlling for age, gender, education, and income.

Theoretical Framework for Study

The theories for this study were the health belief model (HBM) and the theory of planned behavior (TPB). The HBM was developed in the 1950s by Codfrey Hochbaum, S. Stephen Kegeles, Howard Leuenthal, and Irwin Rosenstock, social psychologists in the U.S. Public Health Service. The constructs of this theory are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to actions, and self-efficacy (Rosenstock, 1974). The TPB was developed in 1991 by the social psychologist Icek Ajzen as an extension of the theory of reasoned action, and the constructs of the TPB are attitudes, subjective norms, and perceived behavioral control, all of which are posited to lead to the main construct of intention (Ajzen, 1991). The constructs of both the HBM and the TPB are explained in detail in Chapter 2.

These theories were relevant to my study approach and research questions because they provided a rationale for the choice of variables and the way in which they were examined. It was hypothesized that race-related stress and medical mistrust contribute to the attitudes, subjective norms, and intention in the study population; COVID-19 worry contributes to perceived susceptibility, perceived severity, cues to action, and intention to

adopt COVID-19 health recommendations; and vaccination is an example of a health behavior that can be explained by both theories. The HBM and TPB provided a fitting framework for interpretation of the study results.

Nature of the Study

The objective of this investigation was to test hypotheses and measure the associations between multiple variables without manipulating any of them; therefore, a correlational non-experimental quantitative design was chosen (Creswell & Creswell, 2018). The dependent variables in this study were COVID-19 vaccine hesitancy and COVID-19 vaccine uptake. The independent variables consisted of the predictor variables race-related stress, medical mistrust, and COVID-19 worry, and the control variables age, gender, education, and income. Primary data were collected via an online survey of a convenience sample of non-Hispanic (non-Hispanic) African American adults drawn from Amazon Mechanical Turk (MTurk). MTurk is an online labor market that has been increasingly used for data collection in public health research (Casey et al., 2017; Créquit et al., 2018; Nadler et al., 2021; Walters et al., 2018). I accessed the pool of potential respondents by posting a questionnaire on the MTurk site. Survey data were analyzed by binominal logistic regression to answer each research question.

Definitions

A detailed description of all the variables used in this study, including how they are operationalized, measured, and coded is found in Chapter 3. Here, a concise definition of the study variables and other technical terms used in this research is given.

Independent Variables

COVID-19 worry: Concern, fear, or anxiety about the COVID-19 virus or disease related to the individual, their family, friends, or community (Funk & Tyson, 2021; King et al., 2021).

Medical mistrust: A distrust of the healthcare system, public health officials, health care providers, medical treatments, and medical information based on prior acts of mistreatment or deception experienced personally or vicariously (Bogart et al., 2021a; Dong et al., 2022).

Race-related stress: The psychological and emotional discomfort experienced in response to incidents of racism or discrimination (Utsey, 1999).

Dependent Variables

Vaccine hesitancy: A delay in acceptance or refusal of COVID-19 vaccine despite availability of and access to vaccination services (MacDonald, 2015).

Vaccine uptake: The receipt of at least 1 dose of any FDA approved COVID-19 vaccine.

Covariates

Age: How many years the individual has been alive.

Education: The formal instruction received in a school and/or level of knowledge as measured by an academic degree or certificate.

Gender: The gender endorsed by the individual.

Income: The amount of money an individual earns on a yearly basis from all sources.

Components of Vaccine Hesitancy

Vaccine complacency: The attitude concerning the perceived risks and benefits or necessity of a vaccine (MacDonald, 2015).

Vaccine confidence: Trust in the safety and efficacy of a vaccine, in the system that delivers it, and in the motivation of those who recommend it (MacDonald, 2015).

Vaccine convenience: The availability, affordability, and accessibility of a vaccine (MacDonald, 2015).

Other Terms

Intentional delay: When an individual purposely does not get a first dose of COVID-19 vaccine as soon as they are eligible because they do not want the vaccine or do not want it yet, independent of availability and access.

Vaccination behavior: An individual's decision to delay, refuse, or accept vaccination.

Vaccination status: Whether an individual has received at least 1 dose of a COVID-19 vaccine.

Assumptions

In this study I assumed there are direct and indirect experiences of racial discrimination that are unique to African Americans because of their history and continued treatment in the United States and that those experiences can influence health attitudes and behaviors. I assumed the survey instrument I used to collect the primary data had the same level of validity as the individual scales that were combined to create the questionnaire and that the data collected would be robust enough to correctly shed light on the problem being

investigated. It was also assumed respondents would answer questions truthfully and accurately to the best of their recollection and that they would be able to differentiate issues of vaccine availability and access from the desire to be vaccinated. These were significant assumptions because I was asking participants to recall whether they chose to intentionally delay getting vaccinated when COVID-19 vaccines were first made available in late 2020 and early 2021. However, it was assumed that because of the life changing nature of this pandemic, those details would be recalled with reasonable accuracy. Finally, regarding the MTurk derived research sample, it was assumed that it would be approximately representative of the general African American adult population and that the findings of this study would be moderately generalizable.

Scope and Delimitations

This study was focused on factors that influence COVID-19 vaccine uptake in non-Hispanic African American adults living in the United States only. This cohort was chosen because of the assumption of their unique cultural experiences. Other racial/ethnic groups and Black individuals living outside the United States were excluded to avoid confounding the study results and their interpretation. I did not observe behaviors in this study but collected data on self-reported behaviors. Another boundary of this research was that there are other factors that potentially influence COVID-19 vaccine uptake in the target population that were not considered, such as uptake of other vaccinations, fear of needles, pre-existing health conditions, geographic location, or political affiliation. Because data were collected via an online survey, they do not reflect the experiences and beliefs of African Americans who do not have access to computers or smartphones or who are not

comfortable answering surveys online which restricted broad generalizability.

Limitations

One potential limitation of this study was the use of a novel instrument to collect the data. This was addressed by using previously published and validated scales and items to measure all but one of the variables of interest. This research also relied on self-reported experiences and behaviors and as such was vulnerable to social desirability, which I attempted to mitigate by making the survey anonymous. However, a significant limitation for which there was no mitigation strategy was recall bias, which was unavoidable given the design of the study. This meant the results had to be interpreted with a degree of caution. Finally, the cross-sectional nature of the research prohibited any conclusions of causality between the predictor variables and the outcome variables.

Significance

Despite the limitations, this study made several contributions to the field by shedding light on the COVID-19 vaccination behavior of the study cohort of African Americans and the relationship between their experiences of racism, medical mistrust, concern about the disease and adherence to the public health recommendation to be vaccinated against the virus responsible for a global pandemic. The findings improve understanding of the impact of racism on African American health and inform interventions that target vaccination against preventable diseases in this community or other critical recommendations during future public health emergencies. In addition to positively impacting the health of African Americans, a reduction in racial health disparities would contribute to a yearly financial savings of approximately $310 billion in lost life years, excess healthcare costs, and lost

productivity (Yearby et al., 2020). Finally, results from this study could inform recommendations for evidence-based health policy.

Social Change Implications

Social change has been defined as "the process of shifting attitudes, values, and actions to address social problems in a positive way" (Palumbo, 2014, p. 1), and it is a tenet of Walden University (Walden University, 2017). This study addressed the social problem of racial disparities in COVID-19 by trying to identify factors that contribute to vaccine hesitancy among African Americans, which could inform strategies to improve vaccine uptake in a population disproportionately burdened by this disease. Documenting an association between derivatives of racism and COVID-19 vaccination behavior could help shift attitudes and actions by providing additional support for the assertion that mitigating racism would result in positive public health outcomes (Brannon & Marshall, 2023).

Summary

In this chapter, I provided a background on my research topic of COVID-19 vaccination behavior among African Americans by briefly summarizing the related research and identifying the gap in the literature that this study filled. I introduced the public health problem of African American COVID-19 health disparities that inspired this investigation and shared the specific research questions and hypotheses that I addressed. The theoretical framework and rationale for the research design were given, and key variables and terms used in the study were defined. Finally, I stated the assumptions, scope, limitations, and significance of this study. In Chapter 2, I describe more fully the theoretical framework for this research and provide a detailed review of the literature surrounding this topic.

Chapter 2: Literature Review

The purpose of this investigation was to examine factors that influence COVID-19 vaccination behavior among African Americans. The public health problem that provoked me to search the literature was African American COVID-19 health disparities. In a public health emergency caused by an airborne viral pathogen such as SARS-CoV-2, masking, social distancing, and increased hand hygiene are all effective preventive behaviors (Asare et al., 2020). But even before they were developed, COVID-19 vaccines were heralded as the surest way to end this pandemic (Agarwal et al., 2021; CDC, 2022b; Niño et al., 2021; L. P. Wong et al., 2020). However, vaccines are only effective if the public gets inoculated. The determinants of African American COVID-19 vaccine uptake are both systemic and individual and may be related to the racism experienced by Blacks in America. Racism has been linked to medical mistrust (Bazargan et al., 2021; Johnson et al., 2021), and both phenomena have been identified as social determinants of African American health disparities (Benkert et al., 2019a; Carter et al., 2018; IOM, 2003; Powell et al., 2019).

This study added to the literature by examining the correlation between race-related stress, medical mistrust, COVID-19 worry, and COVID-19 vaccine hesitancy and uptake among African Americans. In this chapter, I describe the search strategy I used to exhaustively identify the pertinent literature underpinning my study. I review and justify the theoretical framework upon which my research was grounded. I summarize and discuss the current literature on African American COVID-19 disparities and analyze and synthesize the literature surrounding the main variables in my study. This chapter ends with a summary and conclusion followed by an introduction of Chapter 3.

Literature Search Strategy

A comprehensive review of the literature was conducted to inform this study. The search terms used included *COVID-19 or coronavirus or 2019-ncov or SARS-CoV-2 or cov-19; vaccine or vaccines or vaccination or immunization or immunizations; acceptance or attitudes or perception; vaccine hesitancy or vaccine refusal; delay; vaccine uptake; herd immunity; African Americans or Black Americans or Blacks;* medical mistrust*; mistrust or distrust or trust or betrayal; racism or discrimination or prejudice or racial bias; race-based stress;* race-related stress*; traumatic experiences or PTSD or traumatic event or potential traumatic exposure; worry or stress or anxiety or fear or concern; health belief model;* and *theory of planned behavior.* The sequence of search terms was changed in repeated searches and the key words were used independently and in various combinations to ensure that all pertinent studies were identified. When the searches ceased to yield any new articles of relevance to my study, the initial search was deemed exhaustive.

The search was conducted using the following databases and search engines: Academic Search Complete, APA PsycInfo, CINAHL Plus with Full Text, Complementary Index, Directory of Open Access Journals, EBSCO, Google Scholar, MEDLINE with Full Text, ProQuest, and the Walden University Library. The scope of the review included English language articles available in full text that were published in peer review journals from 2018 to the present. Also included in this literature review are publications that resulted from professional conference proceedings, data from trusted government websites, and independent reviews and analyses conducted by private public health organizations.

Abstracts of all papers resulting from this primary search were read and articles with

relevance to my research questions and variables of interest were read in their entirety. In a secondary search, the reference lists for the articles initially identified for inclusion were examined to detect other pertinent manuscripts to review. To help ensure the search was comprehensive I also used Google Scholar and the Walden Library to identify articles that cited the papers comprised in this review and to search for other articles not yet identified that were written by authors with expertise relevant to my study. Because research on COVID-19 vaccination was still emerging, I saved the most applicable searches and set up alerts to notify me when new publications matching those search criteria became available.

Theoretical Framework

The theoretical framework for this study was composed of the HBM and the TPB. Both theories were used in the design of this study and in the interpretation of the results.

Health Belief Model

The HBM is an intrapersonal level theory that was developed in the 1950s by social psychologists in the U.S. Public Health Service (Janz & Becker, 1984; Rosenstock, 1974). Intrapersonal theories hypothesize that individual characteristics such as knowledge, beliefs, attitudes, and personality traits influence behavior (Rimer & Glanz, 2005). The developers of the HBM sought to understand and explain "the widespread failure of people to accept disease preventives or screening tests" (Rosenstock, 1974, p. 328) for the early detection or prevention of dental disease, cervical cancer, tuberculosis, and other infectious diseases for which there was an effective vaccine. For a decade after its development, the HBM was widely used in research examining preventive health behaviors and substantial empirical evidence of its ability to predict outcomes in both prospective and retrospective studies was

generated (Janz & Becker, 1984). The HBM continues to be widely used in public health research today, and research has validated the HBM's exploratory and explanatory power as a strength of the model (Tarkang & Zotor, 2015).

The constructs of the HBM that help to explain and predict health behavior are perceived susceptibility to disease, perceived seriousness of the disease, perceived benefit of the recommended preventive behavior, perceived barriers to adopting the behavior, self-efficacy, and cues to action (Janz & Becker, 1984; Rosenstock, 1974). Perceived susceptibility refers to an individual's perception of their personal risk of contracting the disease; the HBM posits the more vulnerable an individual believes they are, the more likely they will be to adopt the recommended behavior (Rosenstock, 1974). Perceived seriousness speaks to an individual's belief about the severity of the illness and is based not only on their understanding or knowledge of the medical impact on them physically but based also on their perception of the impact the disease could have on them socially (Rosenstock, 1974). In the case of COVID-19, this could include the emotional and financial toll of needing to quarantine if you contract the disease.

The construct of perceived benefit is influenced by an individual's opinion about the value of the recommended behavior, not necessarily the facts about the effectiveness of the behavior, and it considers the usefulness of known alternatives (Rosenstock, 1974). This construct may be seminal in the context of COVID-19 where the merit of the recommendation to vaccinate may be weighed against the effectiveness of alternative protective behaviors such as masking, social distancing, and increased hand hygiene. However, it is perceived barriers to adoption that has been found to be the most significant

construct in behavior change and the presumed negative aspects of a particular health behavior may serve as a compelling obstacle to adopting the behavior (Janz & Becker, 1984). The HBM theorizes that an individual conducts something analogous to a cost benefit analysis when considering whether to adopt a recommended behavior (Janz & Becker, 1984; Rosenstock, 1974).

Prior to the pandemic, the HBM was used extensively as a theoretical framework in vaccine research. In a systematic review of the literature, Corace et al. (2016) found the HBM to be the most widely used theory in the study of influenza (flu) vaccine uptake among healthcare workers. Flanagan et al. (2020) continued the trend by selecting the theory as the foundation for their seminal mixed methods study of seasonal flu vaccine uptake among nurses. Fry et al. (2016) used the HBM in their examination of the variables predictive of pneumococcal vaccine uptake and determined perceived susceptibility, perceived barriers, and cues to action were all significant ($p < 0.05$) determinants of vaccination behavior among African American adults. This theory has also been used in several emerging studies of the perceptions of COVID-19 and the intent to be vaccinated against it (Asare et al., 2020; Ellis et al., 2021; Woko et al., 2020; L. P. Wong et al., 2020; M. C. Wong et al., 2021).

Asare et al. (2020) applied the constructs of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy in their examination of the impact of COVID-19 and adherence to public health recommendations. The independent variables in their study were HBM constructs and COVID-19 related stress, and the dependent variables were public health recommendations, anxiety, and depression. The

investigators used social media, text messages, emails, and a snowball method to recruit a convenience sample of 433 participants living in the United States who self-identified as African, African American or Hispanic Black. Results of an online survey they conducted in June 2020 showed over 60% of respondents did not feel susceptible to COVID-19 infection, and over 80% were practicing recommended COVID-19 prevention behaviors. After adjusting for covariates, analysis showed increased perceived severity and perceived benefits were significantly ($p < 0.01$) and positively associated with adherence to recommendations, while increased perceived barriers was significantly ($p < 0.01$) and negatively associated with adherence, and the regression model accounted for 25% of the variance. While the Asare et al. (2020) study did not include vaccination intention among the dependent variables, it supports the rationale for using the HBM as a theoretical foundation in this study. Further support comes from the inclusion of the HBM constructs of perceived susceptibility and perceived seriousness in the widely accepted determinants matrix for vaccine hesitancy (MacDonald, 2015).

Among the strengths of the HBM are its demonstrated capacity to predict and explain preventive health behaviors and its usefulness in informing effective public health interventions that target specific constructs (Fry et al., 2016; Skinner et al., 2015; U.S. Department of Health and Human Services [HHS], 2005). Another strength of this model is the intuitive nature of its constructs, which allows for easy application even among populations with lower heath literacy (Skinner et al., 2015). A weakness of the HBM is that it does not account for individual social cognitive determinants of behavior such as race/ethnicity, lived experiences, and family norms, and it assumes everyone has equal

access to factual information (Badr et al., 2021; Boston University [BU] School of Public Health, 2016). It has been argued that because there are several factors that limit the HBM's usefulness in public health, it should be integrated with other models to be most effective in this context (BU School of Public Health, 2016). For this reason, I also incorporated the TPB into the current research. Many vaccine studies have combined the HBM with other theories (Ellis et al., 2021; Fry et al., 2016; Jones, 2022), and the HBM has been paired with the TPB specifically in several recent vaccine and COVID-19 studies (Badr et al., 2021; Bauler et al., 2022; Chu & Liu, 2021; Darensbourg et al., 2015; Guidry et al., 2021; Short et al., 2022).

Theory of Planned Behavior

The TPB is another intrapersonal level theory of behavior (Rimer & Glanz, 2005). In the 1960s and 1970s, it was widely believed that attitude determined behavior; however, a review of the literature found little evidence to support that assumption (Fishbein & Ajzen, 1975). Consequently, in 1975 Fishbein and Ajzen developed the theory of reasoned action (TRA), the constructs of which are attitudes towards a behavior and subjective norms, and the developers theorized these constructs inform *intention* which is the key determinant of behavior. Research showed the TRA was useful in predicting behavior over which individuals had volitional control, but it was less effective in explaining actions over which individuals did not have the ability to decide at will whether to engage in the behavior (Ajzen, 1991). To address this limitation, Ajzen (1991) added the construct of perceived behavioral control to the original theory to create the TPB. Like the TRA, the TPB posits attitudes toward a behavior are determined by behavioral beliefs and an evaluation of

behavioral outcomes, while subjective norms are determined by normative beliefs and motivation to comply (Ajzen, 1991; Fishbein & Ajzen, 1975). The additional construct of perceived behavioral control is influenced by control beliefs and perceived power, and the three constructs together inform intention, which is labeled the crucial intermediary outcome on the path to preventive health behavior.

The TPB has been used as the theoretical framework in numerous studies on vaccine hesitancy and uptake among Americans (Catalano et al., 2017; Fernandez-Pineda et al., 2020; Kasting et al., 2022; Li et al., 2021; Shah et al., 2021; Stout et al., 2020; Xiao & Wong, 2020), as well as in emerging studies on COVID-19 vaccine intention in the United States. Catalano et al. (2017) used the TPB and stepwise multiple regression to identify factors associated with human papilloma virus (HPV) vaccine status, defined as not being vaccinated against HPV, starting but not completing the vaccine series, and being fully vaccinated. They determined that among the unvaccinated, attitude toward the vaccine (β = 0.175, p = 0.01) and subjective norms (β = 0.682, p = 0.001) were significant determinants of intention to complete the HPV series in the next 12 months and together those constructs predicted 60% ($p < 0.001$) of the model variance. Behavioral intention was found to be a significant predictor (β = 0.303, p = 0.000) of series completion.

Hayashi et al. (2022) used the TPB and hierarchical linear regression to predict COVID-19 vaccine intention and found that expanded TPB constructs accounted for 72.5% of the variance in the model ($p < 0.001$), with perceived behavioral control (β = 0.29, $p <$ 0.001), perceived community benefit (β = 0.23, p = 0.020), and attitude (β = 0.23, p = 0.043) being significant independent predictors of intention. In a study of the relationship between

individual intention to be vaccinated against COVID-19 and the impact of the vaccination choices of others, Agranov et al., (2021) found the construct of social norms was a key driver of individual behavior. Although their study did not use TPB as the theoretical framework, it did provide justification for the use of the subjective norms construct in my study. Further support for the use of the TPB in my research came from inclusion of the constructs of attitude toward vaccination and subjective norms in MacDonald's (2015) benchmark determinants matrix for vaccine hesitancy.

As stated, the TPB has been used in combination with the HBM in several COVID-19 vaccine studies. In research conducted in November-December 2020, immediately before the emergency authorization of the COVID-19 vaccine, Badr et al. (2021) used a combination of HBM and TPB constructs to identify individual level determinants of COVID-19 vaccine hesitancy. They assessed personal risk factors as well as attitudes about COVID-19 and vaccines and found that overall, 43.5% of the 1,208 respondents were hesitant to be vaccinated. Those who expressed greater perceived susceptibility, who perceived the vaccine to be convenient, and who put more importance on cues to action were less likely to be hesitant, as were individuals who engaged in other recommended COVID-19 protective behaviors such as social distancing, masking, and heightened hand hygiene. In their discussion, Badr et al. suggested building trust in the vaccine would be critical to encouraging uptake, particularly among those for whom historical injustices had fostered medical mistrust. Similarly, in a mixed-methods study using the HBM and TRA, Bauler et al. (2022) found that perceived social norms, perceived negative consequences, and trust were the strongest predictors of vaccine refusal. These studies validated the

decision to use the HBM and TPB constructs as the theoretical framework for this investigation, and the rationale for examining the selected predictor and outcome variables.

Literature Review Related to Key Variables

The independent variables in this study were race-related stress, medical mistrust, and COVID-19 worry, and the dependent variables were COVID-19 vaccine hesitancy and COVID-19 vaccine uptake. I searched the literature to find studies related to these variables to determine what was known, what was unknown, and what remained unclear about the relationships between them. A review of the current literature follows.

COVID-19 Vaccine Hesitancy Among African Americans

COVID-19 vaccines first became available to the adult American public in December 2020 under FDA Emergency Use Authorization (EUA), which allows vaccines that have proven to be safe and efficacious but that have not yet been formally approved, to be used outside of a clinical trial (FDA 2021, 2022). The first vaccines to be released under EUA were able to be developed in record time because they were based on messenger ribonucleic acid (mRNA) technology that was already in existence prior to the pandemic. Once the genetic properties of the SARS-CoV-2 virus that causes the disease was identified, scientists were able to quickly synthesize and test mRNA COVID-19 vaccines (CDC, 2022d). However, because the initial supply was limited, the CDC authorized vaccine eligibility in timed phases to prioritized groups and most adults were not eligible to receive a vaccine until April 2021 (C. Latkin et al., 2022). Full FDA approval for the first COVID-19 vaccines was granted in August 2021 (FDA, 2021).

Evidence of COVID-19 Vaccine Hesitancy

The component elements of vaccine hesitancy are confidence, complacency, and convenience (MacDonald, 2015). Because in the United States the COVID-19 vaccines were made broadly available and free to all, convenience may not have been driving vaccine hesitancy in this country. The World Health Organization (WHO)'s Strategic Advisory Group of Experts (SAGE) Working Group that conceived the widely accepted definition and component elements of vaccine hesitancy also developed a determinants matrix that groups the factors that bear upon hesitancy into three categories: contextual influences, individual and group influences, and vaccine specific issues (MacDonald, 2015). All three categories of determinants have been observed in African American COVID-19 vaccine hesitancy and for this population, negative experiences with the healthcare system have been found to be important factors in COVID-19 vaccination behavior.

There is substantial evidence that African Americans have had the lowest or among the lowest intentions to be vaccinated against COVID-19 of all racial/ethnic groups (Carpiano, 2020; Daly & Robinson, 2021; Fisher et al., 2020; Gerretsen et al., 2021; Gibson et al., 2021; Khubchandani & Macias, 2021; Khubchandani et al., 2021; King et al., 2021; C. A. Latkin et al., 2021a; Malik et al., 2020; McElfish et al., 2021; K. H. Nguyen et al., 2021; L. H. Nguyen et al., 2022; Niño et al., 2021; Reiter et al., 2020; Ruiz & Bell, 2021; Szilagyi et al., 2021c). In a systematic review of national studies published in the United States from February 2020 to February 2021 on COVID-19 vaccine hesitancy, Khubchandani and Macias (2021) found that while the overall prevalence rate of COVID-19 vaccine hesitancy was 26.3% (95% CI [17.3, 36.4]) for American adults, the rate was substantially higher at

41.6% (95% CI [34.4, 48.9]) for African Americans. In their review, the authors included studies that examined COVID-19 vaccination hesitancy in national samples of American adults aged 18 years or older and that included hesitancy rates for African Americans and Hispanics, resulting in a final group of 13 studies with a pooled sample of 107,841 participants. The major predictors of African American vaccine hesitancy identified in the articles reviewed included sociodemographic characteristics, experiences of racism, medical mistrust, perceived risk of infection, concerns about COVID-19 vaccine safety and efficacy, compliance with other vaccine recommendations, and exposure to misinformation about COVID-19. However, none of the studies examined the possible interactions between those predictors.

In an April 2020 survey of a nationally representative sample of 991 adults in the United States, Fisher et al. (2020) found the intention to refuse a future COVID-19 vaccine was significantly higher in African Americans than in Whites (relative risk ratio [RRR] = 6.4, 95% CI [3.2, 13.0]). In a larger survey also conducted in April 2020 in a nationally representative sample of 2,279 participants, Kelly et al. (2020) similarly found African Americans to be significantly less likely to be vaccinated than Whites (odds ratio [OR] = 0.4, 95% CI [0.26, 0.64], $p < 0.001$). And in data collected in May to June 2020, Callaghan et al., (2021) found African Americans to be 41% more likely to be vaccine hesitant than Whites (95% CI, upper and lower limits not given, $p < 0.05$). These studies provide corroborating evidence of COVID-19 vaccine hesitancy among African Americans.

More granular evidence is offered by Gerretsen et al. (2021), who administered a web-based survey to U.S. and Canadian adults to examine whether COVID-19 vaccine

hesitancy and two of its three component factors, confidence, and complacency, were more prominent in racial minorities. Data were collected from May to July 2020, and the authors found that compared to Whites, Blacks had significantly higher vaccine hesitancy ($p < 0.001$), the highest of all racial groups, even after controlling for sociodemographic factors. Less than half as many Blacks (33.4%) as Whites (67.4%) indicated they would "definitely" or "very probably" be vaccinated against COVID-19, and although there was no difference in the determinants of vaccine complacency (COVID-19 was perceived with the same degree of seriousness by all racial groups), vaccine confidence was significantly lower ($p < 0.001$) in Blacks as compared to Whites. While these results are consistent with other research, a notable weakness of this study is that of the 4,434 participants recruited from California, Texas, Florida, New York, and Canada, only 219 (4.9%) of them were Black which limits the generalizability of the findings.

In a national assessment conducted in June 2020, Khubchandani et al. (2021) examined COVID-19 vaccine hesitancy in a sample of 1,878 American adults. Overall, the vast majority that responded to the online survey were either very likely (52%) or somewhat likely (27%) to be vaccinated against COVID-19 when vaccines became available; only 7% of respondents said they definitely would not get vaccinated. While race was not found to be a significant predictor of vaccine hesitancy in multiple regression analysis, in unadjusted group comparisons, African Americans were found to be significantly least likely (66%, $p < 0.001$) and most unlikely (34%, $p < 0.001$) to be vaccinated of all racial/ethnic groups. However, the proportion of African Americans (11%) was slightly underrepresented in their sample.

Trends in Vaccine Hesitancy Over Time

The literature reveals that vaccine hesitancy among African Americans has not been a static phenomenon. To examine trends in willingness to be vaccinated against COVID-19, Daly and Robinson (2021) conducted a secondary analysis of data collected in the Understanding America Study (UAS), a longitudinal survey of a nationally representative, probability-based sample of American adults. Daly and Robinson (2021) examined changes in the reported vaccine intentions of 7,547 participants who responded to 13 bi-weekly online questionnaires from April to October 2020. They found that overall, willingness to vaccinate decreased over this time period, from 71.0% in April 2020 to 53.6% in October 2020 and African Americans were approximately twice as likely to be undecided (RR = 2.18, 95% CI [1.73, 2.74], $p < 0.001$) or unwilling (RR = 1.98, 95% CI [1.63, 2.42], $p < 0.001$) to be vaccinated in October 2020 as compared to April 2020. This indicates that as the prospect of a COVID-19 vaccine increased, so did vaccine hesitancy, perhaps due to fears about safety given the speed of vaccine development, as 69.7% of study respondents reported concerns about serious side effects.

Daly and Robinson's (2021) results were corroborated by Szilagyi et al. (2021c) who also conducted a secondary analysis of UAS data to study changes in the likelihood of COVID-19 vaccination over a slightly longer period of time, from April through December 2020. Szilagyi et al. (2021c) found a similar decrease overall in willingness to be vaccinated from 74.1% (95% CI [72.4, 75.8]) to 56.2% (95% CI [54.4, 58.1]) during this period, and among African Americans, they found a decrease from 50.7% (95% CI [44.7, 56.7]) in April 2020 to 37.6% (95% CI [32.0, 43.2]) in December 2020. In Szilagyi et al.'s analyses,

African Americans were also the least likely to get vaccinated among all races/ethnicities in both April and December.

However, when Daly et al. (2021) examined trends in vaccine hesitancy in the same UAS dataset, this time from October 2020 to March 2021, they found that vaccine hesitancy decreased by 10.8 percentage points overall, and by almost twice as much (20.9 percentage points) among African Americans. They also found corresponding increases over this period in measures of combined public trust, government approval process to ensure the safety of the COVID-19 vaccine, and in the process in general to develop safe vaccines (not just for COVID-19), among all races/ethnicities including African Americans. A February 2021 Pew Research Center poll also revealed a decrease in vaccine hesitancy over time as more African Americans were willing to be vaccinated then than were willing in a November 2020 poll (Funk & Tyson, 2021).

Data from Rane et al.'s (2022) longitudinal study showed that from November 2020 to July 2021 the overall OR, adjusted for race/ethnicity, gender, age, and comorbidities, for delaying vaccination declined steadily by 96% (aOR = 0.04, 95% CI [0.03, 0.05], $p <$ 0.001), and by 71% (aOR = 0.29, 95% CI [0.24, 0.35], $p < 0.001$) for vaccine refusal, as compared to the reference month of October 2020. However, the rate of change was slower for African Americans. In December 2020 compared to October 2020, African Americans had 2.8 times (95% CI [2.2, 3.6]) higher odds of delaying vaccination than White Americans after adjusting for age, gender, and comorbidities, and in July 2021 they still had significantly higher odds of delay (aOR 1.7, 95% CI [1.2, 2.5]). Trends in vaccine refusal were mixed. In December 2020 relative to October 2020, the aOR for African American

vaccine refusal was 1.6 (95% CI [1.2, 2.2]) relative to White Americans; however, by July 2021 African Americans were less likely than White American to refuse the vaccine (aOR = 0.6, 95% CI [0.4, 0.8]). This may reflect African American hesitancy to accept the vaccine during EUA (Guidry et al., 2021) and reflect the "wait and see" attitude found toward the COVID-19 vaccine in other studies (Dong et al., 2022; Ignacio et al., 2022; King et al., 2021; Recht & Weber, 2021).

A massive online survey conducted by King et al. (2021) from January 2021 to May 2021 that yielded a total of 5,088,772 responses (aggregated by month) also showed a decrease in COVID-19 vaccine hesitancy after EUA and initial uptake. In this study that asked U.S. Facebook users "if a vaccine to prevent COVID-19 were offered to you today, would you choose to get vaccinated", researchers found the overall proportion of those expressing hesitancy decreased steadily each month from 25.4% (95% CI [25.3, 25.5]) in January 2021 to 16.6% (95% CI [16.4, 16.7]) in May 2021, with the largest decrease (by 1/3) seen among African Americans, the most hesitant racial/ethnic group. Yet, the percentage of those who definitely would not get vaccinated did not change. This suggests there may be a highly COVID-19 vaccine hesitant group that is resistant to changing their position over time. However, of the 525,644 responses received in May 2021, only 28,546 (5.4%) were from African Americans which weakens the generalizability of these results. Nevertheless, taken together the patterns found in the above-described studies demonstrate that after an initial increase in hesitancy in the months leading up to EUA of COVID-19 vaccines in December 2020, hesitancy decreased over time thereafter, as more individuals accepted the vaccine and no serious side effects were reported.

King et al. (2021) found an interaction between race/ethnicity and age in their analyses. Younger African Americans (under 35 years old) were more hesitant than their White peers, while older African Americans (aged 45 years or more) were less hesitant than their White peers. This finding is consistent with other vaccine research which has shown African Americans are not a monolith when it comes vaccine hesitancy and uptake. S. C. Quinn et al. (2018) used a public health critical race praxis theoretical framework to examine African American within group differences in flu vaccine-related measures (knowledge, attitudes, perceived risk) and racial factors (perceived discrimination, racial fairness, racial salience) and found significant subgroup differences by age, education, and income in flu vaccine confidence and hesitancy. Freimuth et al. (2017) also found heterogeneity among African Americans, by age and income, in flu vaccine behavior and concluded the most important subgroups to target for tailored messages to promote flu vaccine uptake were younger, lower income African Americans.

Factors Contributing to Vaccination Intention

Some research has delved more deeply into COVID-19 vaccine hesitancy to examine the reasons for it. King et al. (2021) found independent predictors of hesitancy overall included lack of worry about COVID-19 (RR = 3.66, 95% CI [3.58, 3.74]) and no past-year flu vaccine (RR = 4.97, 95% CI [4.85, 5.08]). Callaghan et al. (2021) also found worry about COVID-19 to be a factor in vaccine hesitancy and determined a one-unit increase in worry about COVID-19 was associated with a 23% decrease in vaccine refusal. Significant racial differences in the reasons for vaccine refusal were detected by Callaghan et al. (2021), with African Americans reporting a significantly higher rate of concern about the vaccine's safety

(p <0.01) and effectiveness (p <0.01) than Whites.

Of those who were vaccine hesitant in King et al.'s (2021) study, overall 49.2% (95% CI [48.7, 49.7]) reported concerns about side effects, 48.4% (95% CI [48.0, 48.9]) indicated a lack of trust in the COVID-19 vaccine, and over 1/3 were of the opinion they did not need the vaccine, expressed a lack of trust in the government, and indicated they were waiting to see if the vaccine was safe. Yet these reasons for hesitancy were nuanced and varied by degree of hesitancy. Among those who "definitely would not" choose to be vaccinated, lack of trust in the government and lack of trust in the COVID-19 vaccine were the most frequently reported reasons for vaccine hesitancy, at 59.2% (95% CI [58.6, 59.8]) and 51.2% (95% CI [50.6, 51.7]) respectively. These rates were twice as high as those among adults who would "probably not" be vaccinated and four times as high as the rates among those who "probably would" be vaccinated. Conversely, 52.3% (95% CI [51.5, 53.1]) of the "probably not" group expressed a wait and see if it was safe attitude, more than double the 24.3% (95% CI [23.8, 24.8]) of the "definitely not" group. The authors did not report any stratification by race for these variations in degree of hesitancy, but a December 2020 KFF poll on COVID-19 vaccination (Recht & Weber, 2021) revealed the same wait and see mindset among African American respondents that was found by King et al. (2021) in the "probably not" group.

Guidry et al. (2021) used HBM and TPB constructs to examine the psychological willingness of Americans to receive a COVID-19 vaccination under EUA. They administered an online survey in July 2020 to 788 participants with equal representation of gender (male and female, 50% each) and race/ethnicity (White [34%], African American

[33.4%], and Hispanic [32.6%]). Measurements included assessments of perceived severity and susceptibility to COVID-19, perceived benefits and barriers to vaccination, self-efficacy, attitude towards COVID-19, subjective norms, perceived behavioral control, and intention to be vaccinated. An ANOVA indicated that African Americans were significantly less likely than Whites ($p = 0.001$) and Hispanics ($p < 0.001$) to intend to get a future COVID-19 vaccine and significantly less willing than Whites ($p = 0.001$) and Hispanics ($p < 0.001$) to get one under EUA. Bivariate correlation results showed intention to be vaccinated was positively associated with attitudes ($r = 0.550$, $p < 0.01$), perceived benefits ($r = 0.467$, $p < 0.01$), subjective norms ($r = 0.459$, $p < 0.01$), EUA willingness ($r = 0.383$, $p <0.001$), self-efficacy ($r = 0.338$, $p < 0.01$), perceived susceptibility ($r = 0.272$, $p < 0.01$), and perceived severity ($r = 0.226$, $p < 0.01$); negatively associated with perceived barriers ($r = -0.358$, $p < 0.01$); and no association was found with perceived behavioral control. Based on the correlation matrix table, willingness to receive a COVID-19 vaccination under EUA was positively correlated with perceived benefits ($r = 0.480$, $p < 0.01$), subjective norms ($r = 0.444$, $p < 0.01$), attitudes ($r = 0.435$, $p < 0.01$), self-efficacy ($r = 0.327$, $p < 0.01$), perceived susceptibility ($r = 0.217$, $p < 0.01$), and perceived severity ($r = 0.129$, $p < 0.05$); and negatively associated with perceived barriers ($r = -0.321$, $p < 0.01$) and perceived behavioral control ($r = -0.096$, $p < 0.01$) (Guidry et al., 2021).

Hierarchical multiple regression models that included blocks of sociodemographic predictors, TPB constructs, and HBM constructs for predicting intention to be vaccinated, and willingness to be vaccinated under EAU, accounted for 66.6% and 35.5% respectively of the variance (Guidry et al., 2021). In all blocks, African Americans were significantly less

likely than Whites to intend to get a future COVID-19 vaccination ($p < 0.05$), and to be willing to get a vaccine under EUA ($p < 0.05$). While the sample in this study was not nationally representative, the overrepresentation of African Americans reinforces the significance of the findings for this population.

In data collected in April 2021, Hayashi et al. (2022) used hierarchical linear regression to examine the associations between TPB constructs and intention to be vaccinated. Their relatively small (n = 162) study of a non-representative sample of U.S. adults that stratified race simply as White (reference) and non-White, found the model that included three non-TPB variables (anticipated regret, locus of control, and community benefit) explained 72.5% ($p < 0.001$) of the variance in intention overall. Attitude, community benefit, and perceived behavioral control were each independent and significant predictors of COVID-19 vaccination intention ($p < 0.05$). Both the Guidry et al. (2021) and Hayashi et al. (2022) studies demonstrate that before full FDA approval of COVID-19 vaccines in August 2021, attitudes and subjective norms were significant predictors of intention to be vaccinated.

In a study that examined data collected in September 2020 via an online survey of a nationally representative sample of 934 Americans, Chu and Liu (2021) found that overall, fear of disease exposure, perceived community benefit, positive attitudes towards vaccines, and recent vaccine history were positively associated with vaccination intent, while safety concerns negatively impacted intent to vaccinate. Their data showed most people were likely to get vaccinated against COVID-19 once the vaccines became available and there was no significant effect of race on vaccine intention after controlling for the HBM constructs used

in the study.

Yet a February 2021 poll found that African Americans were distinct from other racial groups in their higher perception of susceptibility to the disease and concern about unknowingly spreading the virus in the community (Funk & Tyson, 2021). Factors that positively influenced the decision to be vaccinated overall in this sample included trust, concern for community health, and previous flu vaccination. However, 34% of the Africans Americans surveyed reported having little or no confidence in the research and development (R&D) process for the vaccine and another 42% reported only a fair amount confidence. Notably, of the 34% with low confidence in the vaccine, the vast majority (72%) reported they did not intend to be vaccinated against COVID-19.

In qualitative data collected in April and June through July 2020, Ellis et al. (2021) found that African Americans demonstrated lower perceived susceptibility and perceived severity of COVID-19 than Whites, despite widespread reporting of the racial disparities in COVID-19 outcomes. However, the authors were only able to recruit 2 African Americans out of the 26 participants interviewed, so the results have limited generalizability. Nevertheless, there is conflicting evidence surrounding the HBM construct of perceived susceptibility that may reflect dynamic changes over time.

A mixed-methods investigation conducted by researchers at the RAND Corporation (Bogart et al., 2021a; Dong et al., 2022) provided more insight on the reasons for COVID-19 vaccine hesitancy among African Americans. Participants were recruited from the nationally representative pool of over 3,000 members of the RAND American Life Panel (ALP). In the first arm of the study, conducted immediately prior to vaccine EUA in December 2020,

researchers (Bogart et al., 2021a) analyzed online survey responses from 207 of the African American participants in the ALP and found that 35% were vaccine hesitant and another 25% were unsure. Significant predictors of vaccine hesitancy included mistrust of the vaccine itself (OR = 2.2, 95% CI [1.2, 3.9], $p = 0.007$) and weak subjective norms for vaccination (OR = 0.6, 95% CI [0.4, 0.7], $p < 0.001$). Researchers (Dong et al., 2022) then conducted semi-structured interviews from December 2020 to March 2021 with 24 of the survey respondents who endorsed low vaccine intention in the web-based survey. Those interviews revealed a major determinant of the low vaccine intention was general health care distrust derived from Tuskegee and other medical experimentation as well as from personal interactions with the medical system. Participants expressed a "wait-and-see" attitude towards vaccination which was consistent with the finding that those interviewed later in the study described changing their minds about getting vaccinated after seeing few if any negative side effects from the vaccine over the passage of time.

Ignacio et al. (2022) examined COVID-19 attitudes and vaccination behavior among three racial/ethnic minority groups (African American, Native American, and Hispanic) in Arizona. From February to August 2021, investigators conducted semi-structured same-race focused groups with a total of 153 participants. Prior to the focus groups, participants were invited to complete an anonymous online survey to which 137 participants responded, of which, 42 (30.7%) were African American. Survey questions were used to collect data on group demographics, and on vaccination status and experiences, to supplement the qualitative data collected in the focus groups. Results indicated 61.9% of African Americans were already vaccinated, so focus group conversations concentrated on participants'

decision-making processes and extent to which their decision influenced the decisions of others to get vaccinated. Of the African Americans who were not yet vaccinated, only 12.5% reported being "not at all likely" to be vaccinated. Survey responses indicated the most common reasons for the decision to be vaccinated among African Americans were not wanting to get really sick from COVID-19 (62.5%), the desire to keep their family (68.8%) and their community (56.3%) safe and wanting to feel safe around others (50%).

In the focus group discussions about vaccine hesitancy, Ignacio et al. (2022) found many African Americans endorsed having (had) a "wait and see" attitude towards the vaccine, due to the speed of vaccine development, concerns about potential side effects, and uncertainty created by disinformation. Many focus group participants expressed wanting more time as a factor in their decision making. Another major theme in this population was mistrust due to historical and current experiences of racism, with many participants voicing the idea of not wanting to be a "human guinea pig".

COVID-19 Vaccine Uptake Among African Americans

Not only is vaccine uptake essential to ending the COVID-19 pandemic, but timely uptake is crucial as some have shown the consequences of delayed vaccination could be profound. Albani et al. (2021) estimated parameters of a Susceptible-Exposed-Infective-Recovered (SEIR) like epidemiological model to quantify the impact of delay in COVID-19 vaccination in Chicago and New York City (NYC), using publicly available data and accounting for different levels of asymptomatic infection, disease severity, changes in disease spread, and age range. Based on SEIR model predictions using the estimated parameters, delaying the start date of a vaccination campaign from December 2020 (when

EUA for COVID-19 vaccines was granted for prioritized groups) to April 2021 (when most adults became eligible for the vaccine under EUA) would result in approximately 20% more cases, 10% more hospitalizations, and 23% more deaths in Chicago, and a staggering 458% increase in cases, 456% increase in hospitalizations, and 436% increase in deaths in NYC. The population most severely impacted by a delay in COVID-19 vaccination would be the most vulnerable population – African Americans.

Evidence of Disparity in Vaccine Uptake

Unvaccinated individuals of all races are at increased risk of infection, severe illness, and death from COVID-19 (CDC, 2022e; Ndugga et al., 2022) and despite the fact that African Americans are at greater risk (Asare et al., 2020; Bunch, 2021; CDC, 2023a; L. Hill & Artiga, 2022), this population has among the lowest vaccination rates of all racial/ethnic groups in America (Kriss et al., 2022; Ndugga et al., 2022; Rane et al., 2022; Siegel et al., 2021). One reason for the racial disparities in COVID-19 morbidity and mortality is the disproportionately high rate of comorbid chronic disease in among African Americans (Ferdinand et al., 2020; Jones, 2022; S. J. Kim & Bostwick, 2020; Savoia et al., 2021). This baseline state of compromised health makes this population more vulnerable to severe disease and death from COVID-19 (Asare et al., 2020; Ferdinand et al., 2020). Racial disparities in COVID-19 vaccine uptake further exacerbate the racial disparities in COVID-19 morbidity and mortality. However, variations in how and what data are collected and reported have resulted in mixed findings on the extent of vaccination disparities, and the disparities also vary by geographic location.

A large cohort study comparing data from the United States and U.K. that was

conducted from March 2020 to February 2021 revealed differences in COVID-19 vaccine patterns among Blacks living in each country and shed more light on the determinants of African American vaccine uptake (L. H. Nguyen et al., 2022). In a sample of 87,388 participants from the United States, the aOR for vaccine hesitancy among Black Americans as compared to White Americans was 3.15 (95% CI [2.86, 3.47]), and in the sample of 1,254,294 participants from the U.K. the aOR for vaccine hesitancy of Blacks relative to Whites (2.84, 95% CI [2.69, 2.99]) was similarly elevated. In the United States, Blacks were found to be less likely to be vaccinated than Whites (aOR = 0.71, 95% CI [0.64, 0.79]), even among those who expressed a willingness to be vaccinated (aOR = 0.82, 95% CI [0.73, 0.92]). However, there were no disparities in vaccine uptake between the two racial groups in the U.K. This notable difference in vaccine uptake among Blacks living in these two countries, despite their similar levels of hesitancy, suggests some unique contributing factor to vaccine uptake among Blacks in the United States.

As of January 2021, of the 17 states that reported COVID-19 vaccination rates by race/ethnicity to the CDC, 16 showed rates of vaccination among African Americans were disproportionately lower than their population and rate of infection in the state and 15 states reported vaccination rates among African Americans that were lower than their share of deaths from the disease (Ndugga et al., 2021). Although not nationally representative, these data reveal early vaccination uptake was at odds with the racial make-up of those most severely affected by the virus. Reasons for the low vaccination rates among African Americans are still being studied, but in addition to intrapersonal explanations, socio-structural issues such as inequitable distribution and barriers to access have been identified

(Agarwal et al., 2021; Dong et al., 2022; Gayle & Childress, 2021; Siegel et al., 2021).

A secondary analysis of county level data from the five most populous jurisdictions in the state of Texas examined vaccination rates over a period of time from March 2021 to July 2021 (Chen et al., 2022). Researchers found that initial vaccination rates among African Americans (2.1% - 5.3%) and Hispanics (3.2% - 6.4%) lagged behind those of Whites (6.9% - 13.4%) and Asian Americans (7.1% - 12.1%) when the vaccine supplies were limited. This disparity could have been due to differential distribution of or access to the vaccines. At the study end point, when vaccine availability had increased so had uptake among all demographics, and researchers found that all counties studied experienced a decrease in the amount of overall disparity between racial groups over time. However, the vaccination rates among African Americans (27.6% - 34.3%) increased at a slower pace than Hispanics (34.1% - 45.0%) and racial disparities persisted, with vaccination rates among Whites (43.3% - 58.2%) and Asian Americans (52.8% - 75.5%) remaining substantially higher.

Trends in Vaccine Uptake

As with COVID-19 vaccine hesitancy, there is research that indicates trends in vaccine uptake over time, but the data are mixed. A February 2021 Pew Research Center survey of a nationally representative sample of 10,121 Americans found the percentage of African Americans who indicated they either planned to or already had received a COVID-19 vaccine (61%) had increased dramatically from the 42% who indicated acceptance in November 2020, and the disparity between African American vaccine acceptance and White American acceptance had fallen from a 19-point gap down to an 8-point differential (Funk & Tyson, 2021). However, CDC analysis (Kriss et al., 2022) of data collected in an

immunization phone survey of a larger nationally representative sample of 516,190 individuals over a longer period of time, from December 2020 to November 2021, showed the proportion of African Americans (46.3%) who had received at least 1 dose of the vaccine lagged significantly behind (-12.7, 95% CI [-13.6,-11.8], $p < 0.05$) the proportion of White Americans in April 2021, when vaccine eligibility was opened to all adults. The extent of the disparity also varied by region, urbanicity, age, income, and health insurance status with African American vaccination being significantly lower ($p < 0.05$) in every category except rural settings where there was no statistically significant difference. However, by November 2021 the overall differential had all but disappeared, down to -0.5% for African Americans with a rate of vaccination for both groups around 78.5%.

The CDC analysis (Kriss et al., 2022) also revealed significant differences between subgroups of the races. Compared to their White peers in November 2021, African Americans aged 18-29 years, in the Midwest, and in urban settings continued to have vaccination rates that were significantly lower ($p < 0.05$), while African Americans aged 50-64 years, in the South, in rural setting, who were uninsured, and whose income was below poverty level had vaccination rates that were significantly *higher* ($p < 0.05$) than their White peers. Notwithstanding the racial parity seen overall in primary dose vaccination in November 2021, investigators did find evidence of racial disparities in booster uptake. Yet, by April 2022, the COVID-19 Vaccine Monitor phone survey conducted by the KFF in a nationally representative sample of 1,889 adults indicated racial parity in the booster rates as well, with equal shares (73%) of eligible African Americans and White Americans reporting receiving a booster shot (Sparks et al., 2022).

In July 2022 federal data from the CDC also showed that by then racial disparities in vaccine uptake had decreased over time (Ndugga et al., 2022), perhaps because of increased supply and access to vaccine, and perhaps because initial hesitancy among African Americans to accept the vaccine under EUA had waned since its full approval in August 2021. Across the 36 states for which vaccination rate by race/ethnicity could be calculated, Ndugga et al. (2022) found that between April 2021 when most adults became eligible to be vaccinated and July 2022, the gap in African American (24%) and White (38%) inoculation decreased from 14 percentage points to 5 percentage points (59% vs. 64% respectively). However, at 59% the proportion of African Americans who had received at least one dose of the vaccine was still the lowest among all racial/ethnic groups. In addition, these authors found a disparity in the booster rates among those who were fully vaccinated and eligible, with 56% of the White population having received the extra protection compared to only 44% of the African American population. However, a critical challenge to meaningful evaluation of vaccination patterns and trends over time is that by July 2022 some states had reduced or stopped reporting data by race altogether (Ndugga et al., 2022).

Predictors of COVID-19 Vaccine Uptake

Although the evidence is mixed and some researchers have found that COVID-19 vaccine hesitancy is not a significant predictor of disparities in vaccine uptake (Agarwal et al., 2021; Chu & Liu, 2021; Siegel et al., 2021; Stoler et al., 2021), other studies have found a statistically significant association between vaccine hesitancy and lower vaccination rates among African Americans (L. H. Nguyen et al., 2022; Rane et al., 2022). Perhaps the most salient data currently available on determinants of vaccine uptake are found in longitudinal

studies. In the large prospective study conducted by Rane et al. (2022) from October 2020 to July 2021 across 8 time points, results showed that in June 2021, 88.3% of respondents indicated they would immediately or had already received a vaccine, 8.8% indicated they were vaccine delayers, and 5.9% refused to be vaccinated. African Americans were found to be significantly more likely to be delayers (aOR = 1.99, 95% CI [1.47, 2.71], $p < 0.001$) and the most likely to be refusers (aOR = 2.53, 95% CI [1.78, 3.59], $p < 0.001$) among all racial groups as compared to White Americans.

Although African Americans were underrepresented overall in the Rane et al. (2022) cohort (9.9% of the 4,571 respondents) and underrepresented in the demographics of those who would immediately or had already received the vaccine (8.2%), they were overrepresented among those who indicated a delay (18.7%) or refusal (22.3%) to be vaccinated ($p < 0.001$). Overall, in July 2021, Rane et al. (2022) found a strong and significant association between vaccine hesitancy (as reported in the month prior to receiving the vaccine) and vaccine uptake. Those who endorsed delaying had an aOR = 0.15 (95% CI [0.13, 0.18], $p <0.001$) for vaccination while those who endorsed refusing had an aOR = 0.02 (95% CI [0.01, 0.03], $p <0.001$) for vaccination, and the likelihood of vaccination was found to be significantly lower among hesitant African Americans (aOR = 0.71, 95% CI [0.56, 0.91], $p = 0.007$) than among their White peers.

In their examination of prospective predictors of COVID-19 vaccine uptake, C. Latkin et al. (2022) compared data collected from a sample of 161 individuals in early March 2021 to data from the same sample in mid-June 2021. Multivariable logistic regression models showed uncertainty about what source of information to trust (aOR =

0.51, 95% CI [0.27, 0.95]), concerns about vaccine R&D (aOR = 0.43, 95% CI [0.23, 0.81]), and discouraging social norms (aOR = 0.26, 95% CI [0.07, 0.98]), were all significant ($p \leq 0.05$) independent determinants of lower vaccine uptake. However, their bivariate logistic regression models revealed no racial differences in the odds of getting vaccinated. The authors acknowledged this finding may have been attributable to the fact that the sample size was too small to stratify by race/ethnicity.

Vaccine hesitancy among African Americans is not limited to COVID-19 and vaccine acceptance for other preventable diseases has been associated with COVID-19 vaccine uptake among African Americans (Agarwal et al., 2021; Fisher et al., 2020; Kelly et al., 2020; King et al., 2021; Rane et al., 2022). Rane et al. (2022) found that 96% of the of study participants who received a flu vaccine in the prior year indicated they already had or would immediately receive a COVID-19 vaccine, demonstrating a strong correlation between flu vaccination and COVID-19 vaccination.

In their analysis of secondary federal, state, and other data from April 2021 representing 51.5% of the nation's population, Agarwal et al. (2021) examined the difference in COVID-19 vaccine disparities (CVD) and flu vaccine disparities (FVD) in the United States at the county level and found that while FVD was greater than CVD, FVD was a significant predictor of CVD ($p < 0.001$). This finding reinforces the MacDonald (2015) tenet that vaccine hesitancy is context specific, and it may reflect the more serious nature of COVID-19 disease relative to the flu as perceived seriousness of disease is a positive predictor of vaccination intention (Gerretsen et al., 2021).

Similar associations between flu vaccination and COVID-19 vaccination have been

found by other researchers. Fisher et al. (2020) found that people who had been vaccinated against the flu within the past year had a 94% lower relative likelihood of rejecting a COVID-19 vaccine when it became available (RRR = 0.06, 95% CI [0.03, 0.11]) and Kelly et al., (2020) found individuals who had been vaccinated against the flu were 5.25 times more likely (95% CI [3.95, 6.98], $p < 0.001$) to be willing to be vaccinated against COVID-19. In keeping with these findings, results from King et al. (2021) revealed that even after controlling for a broad list of covariates, people who had not received a flu vaccine in the past year were almost 5 times more likely (RR = 4.97, 95% CI [4.85, 5.08]) to be COVID-19 vaccine hesitant.

COVID-19 Worry

There is evidence that worry, fear or anxiety about the seriousness of the disease, personal susceptibility, and risk to family and community members influences COVID-19 vaccine intentions. As reported earlier, Gerretsen et al. (2021) found perceived seriousness of disease was a positive predictor of vaccination intention. King et al. (2021) found a lack of worry about COVID-19 was a predictor of vaccine hesitancy and Callaghan et al. (2021) determined a one-unit increase in worry about COVID-19 was associated with a 23% decrease in vaccine refusal. Funk and Tyson (2021) found concern for community health positively influenced the decision to be vaccinated overall and African Americans were distinct from other racial groups in their higher perception of susceptibility to COVID-19 and concern about unknowingly spreading the disease in the community. Ignacio et al. (2022) found the most common reasons for vaccination among African Americans were not wanting to get extremely sick from COVID-19, the desire to keep their family and their

community safe and wanting to feel safe around others.

In an analysis of online survey data collected from a sample of 1,205 Arkansas adults in July-August 2020, Willis et al. (2021) found respondents who endorsed no fear of COVID-19 infection were significantly much more likely (OR = 5.48, SE = 0.34, $p < 0.001$) to be vaccine hesitant than respondents who feared infection to a great extent. In September 2020, Chu and Liu (2021) found that overall, fear was a significant positive predictor of vaccination intent (β [SE] = 0.050 [0.018], $p < 0.01$) as were the perceived community benefits of vaccination (β [SE] = 0.228 [0.089], $p < 0.01$). In addition, their representative sample of 934 participants agreed COVID-19 was a severe health risk as measured on a scale from 1 (strongly disagree) to 5 (strongly agree) with excellent reliability ($M = 4.21$, $SD = 0.89$, $\alpha = 0.92$). In a similar study of data collected between October 2020 and January 2021 from 754 adults residing, working, and receiving health care in Arkansas, McElfish et al. (2021) found vaccine hesitancy was significantly higher among respondents who endorsed no fear ($OR = 5.51$, $p < 0.001$) and very little fear ($OR = 1.95$, $p < 0.05$) as compared to those who endorsed fear of COVID-19 infection to a great extent.

In a study described in further detail in the medical mistrust discussion that follows, Minaya et al. (2022) tested the hypothesis that higher COVID-19 related fears or worries would positively predict intent to vaccinate in a group of racial-ethnic minorities. Using the COVID-19 Stress Scale, an instrument containing 5 subscales, they found that among African Americans 2 subscales, COVID-19-related danger and contamination, and compulsive checking, were positively correlated with intent to vaccinate ($\beta = 0.04$, $p = 0.031$ and $\beta = 0.11$, $p < 0.001$ respectively). Data were collected in December 2020, around the

time EUA was granted for COVID-19 vaccines.

Medical Mistrust Among African Americans

Medical mistrust has been defined as "distrust of the healthcare system, providers, and treatments" (Dong et al., 2022, p. 2), and has been characterized as "an understandable, rational, self-protective response to historical and ongoing structural and interpersonal discrimination and racism in healthcare, and lack of trust-worthiness of healthcare systems and institutions in U.S. society" (Bogart et al., 2021a, p. 600). This characterization exemplifies a shift in the literature to view medical mistrust as an adaptive and justifiable response of African Americans to historical injustices and negative personal experiences (Benkert et al., 2019a; Bogart et al., 2021c; Bunch, 2021; IOM, 2003; Jaiswal & Halkitis, 2019; Johnson et al., 2021; Manning, 2020; Njoku et al., 2021; Stoler et al., 2021). It has recently been put forth that African Americans reasonably have higher mistrust and thus the issue is more appropriately framed as a lack of trustworthiness of the racial majority (Best et al., 2021; Bunch, 2021; Warren et al., 2020).

This systemic lack of trustworthiness results in negative health outcomes for African Americans (Bogart et al., 2021c; Cruz & Palmer, 2015; Jaiswal & Halkitis, 2019; Njoku et al., 2021; Paradies et al., 2015; Polanco-Roman et al., 2016; Powell et al., 2019; Sibrava et al., 2019; Thames et al., 2019; Williams et al., 2019), and medical mistrust may be a part of the subjective norm in the African American community (Laurencin et al., 2021). In addition to negative personal experiences, among the most often cited reasons for medical mistrust are public health atrocities committed against African Americans by renown healthcare providers and institutions, such as the unanesthetized medical experimentation on

enslaved black women by the venerated father of modern gynecology J. Marion Sims, the unauthorized use and uncompensated immortalization of Henrietta Lack's cancer cells for research by Johns Hopkins University, and the infamous 40-year long *Tuskegee Study of Untreated Syphilis in the Negro Male* conducted by the U.S. Public Health Service and continued for decades after the discovery that penicillin could cure the disease (Bajaj & Stanford, 2021; Bazargan et al., 2021; Bogart et al., 2021a; Dong et al., 2022; Jaiswal & Halkitis, 2019; Madorsky et al., 2021; Manning, 2020; Scharff et al., 2010). Benkert et al. (2019a) maintain medical mistrust should not be interpreted outside the historical and contemporary context of cultural racism and several researchers have concluded mistrust not only implies a lack of trust but infers the person or institution that is the object of mistrust is suspected of being capable of acting in ways that might be harmful (Jaiswal & Halkitis, 2019; Williamson & Bigman, 2018).

Medical mistrust has also been described as "ubiquitous yet unclear" by Benkert et al. (2019a) who conducted a systematic review of 124 peer-reviewed articles, published in English between 1998 and 2018 (88 quantitative, 36 qualitative), related to medical mistrust in healthcare. Using the Williams and Mohammed (2013) racism and health framework as the theoretical guide for their analysis, they found divergence in the empirical literature in how medical mistrust was operationalized, treated either as an element of interpersonal trust along a continuum from high to low, or as a completely independent concept distinct from interpersonal trust. The findings of Benkert et al. (2019a) are consistent with the findings of Williamson and Bigman (2018) who also pointed out that mistrust and trust are related but distinct concepts. Benkert and colleagues also align with Thompson et al. (2004) in their

assessment that medical mistrust is group-based and represents distrust of those outside one's group or distrust in the systems in which one's group is devalued.

In the 36 qualitative studies reviewed by Benkert et al. (2019a) they identified the following three most common characterizations of medical mistrust: interpersonal mistrust (83.3%), systemic mistrust (61.1%), and vicarious mistrust (50.0%), and for African Americans, medical mistrust was commonly associated with personal or empathetic experiences of racial discrimination. This latter finding resonates with research conducted by Johnson et al. (2021) on the correlates of medical mistrust, which suggested medical mistrust is not a derivative of race per se, but of the accumulation over a lifetime of experiences of racism suffered because of one's race. In the 88 quantitative articles reviewed by Benkert et al., they found medical mistrust was hypothesized as a predictor variable, a mediator, or a moderator of outcome measures, and the majority of studies employed cross-sectional designs and multivariate linear and/or logistic regression analyses to establish associations between race/ethnicity, medical mistrust, and outcome.

As stated above, though medical mistrust and trust are distinct concepts they are related, and research has shown trust can be tactical or situational. Nong et al., (2021) reported evidence in the literature of a "strategic trust" in public health, that is "the belief that a given entity will act in one's best interest for a particular purpose" (p. 2), and they note this trust may function differently when placed in different trustees or at different times. Furthermore, they contend the literature indicates that in the context of a public health crisis individuals may exhibit a strategic trust that operates uniquely from how it functions in other contexts. This suggests that even when medical mistrust is high among African Americans,

it might be suppressed or overridden in the face of a life-threatening COVID-19 pandemic in which the risk of serious illness and death is higher for them.

Measures of Medical Mistrust

In their systematic review, which focused on the scales and indices used to measure medical mistrust, Williamson and Bigman (2018) found the literature to be replete with variations in how medical mistrust was conceptualized and operationalized. Their review included 185 quantitative studies published in English prior to August 2016 that had as an objective to measure medical mistrust. Their analysis identified three validated scales that accounted for 49% of the medical mistrust measures: the Group Based Medical Mistrust Scale (GBMMS), the Medical Mistrust Index (MMI), and the Health Care System Distrust Scale (HCSDS). Approximately 22% of the studies used single-item measures of medical mistrust or a few new items not part of a previously validated scale. The remaining papers reported the use of other validated scales, subscales, or newly created scales to measure medical mistrust. When considering the three most widely used scales, Williamson and Bigman found the GBMMS and MMI were predominantly used with African American populations and the HCSDS was predominantly used when race was not being considered.

Consistent with those findings, Jaiswal and Halkitis (2019) and Benkert et al. (2019a) also observed the two scales most commonly used in the literature to measure medical mistrust are the GBMMS and the MMI. Williamson and Bigman (2018) determined the referent for the GBMMS was a group and the object for most of its items were system-personal, i.e., the scale assessed whether members of a racial group distrusted medical personnel. They determined the MMI included both personal and general referents and

contained items that reflected both system-personal and system-institutional objects, i.e., the scale assessed individual beliefs about both medical personnel and medical organizations, with a heavy focus on a general view (*people* should versus *I* should). The MMI has been used as a measure of individual-level medical mistrust while the GBMMS has been used as a measure of group-level medical mistrust (Minaya et al., 2022).

Medical Mistrust and COVID-19

Many studies have found that higher medical mistrust is a statistically significant determinant of African American health behaviors (Benkert et al., 2019a) and it has been identified as a social determinant of health disparities (Armstrong et al., 2013; Benkert et al., 2019a; Bogart et al., 2021a, 2021b; IOM, 2003). Medical mistrust has been associated with delays in routine medical screenings and doctor's appointments, non-compliance with public health recommendations, and specifically with COVID-19 vaccine hesitancy in African Americans (Bogart et al., 2021a, 2021b, 2021c; Johnson et al., 2021; LaVeist et al., 2009; Powell et al., 2019; Sutton et al., 2019). In a survey of 101 African American adults living with HIV conducted from May to July 2020, almost all participants (97%) endorsed at least one mistrust belief about COVID-19, 3/5 believed the government could not be trusted to tell the truth about the disease, and 1/3 reported if a vaccine were available to prevent COVID-19 they would not trust it (Bogart et al., 2021c). Stoler et al. (2021) found that in survey data collected in June 2020 from a nationally representative sample of 1,032 respondents, African Americans were significantly less willing to be vaccinated against COVID-19 (β = -0.505, 95% CI [-0.913, -0.098], p = 0.015), even at the highest levels of trust in health institutions (THI). The African American – THI interaction term was

significantly negatively associated with vaccine willingness (β = -0.351, 95% CI [-0.675, -0.027], p = 0.034), indicating the relationship between THI and willingness to be vaccinated was moderated by African American race.

Thompson et al. (2021) studied the association between race/ethnicity, medical mistrust, and rejection of COVID-19 vaccine trial participation and uptake in a convenience sample of 1,835 adults in Michigan (52% White, 21% African American), who were surveyed from June to December 2020. Overall, 75% of participants expressed low willingness to participate in vaccine clinical trials and 52% expressed low willingness to be vaccinated. Medical mistrust was a significant predictor of both clinical trial rejection (β [SE] = 0.13 [0.04], p = 0.001) and vaccine rejection (β [SE] = 0.21 [0.04], $p < 0.001$) and one-way ANOVA revealed African Americans endorsed the highest level of medical mistrust of all racial groups ($p < 0.001$). Using path analysis as a statistical approach to test the fit of their proposed model, the authors found African Americans showed significantly higher rejection of vaccine trial (β [SE] = 0.51 [0.08], $p < 0.001$) and vaccine uptake (β [SE] = 0.51 [0.08], $p < 0.001$) compared with overall mean rejection and that relationship was partially mediated by medical mistrust (vaccine trial: [β {SE} = 0.04 {0.01}, p = 0.003]; vaccine uptake [β {SE} = 0.07 {0.02}, $p < 0.001$]). In qualitative research conducted in Los Angeles County among racial and ethnic minorities from November 2020 to January 2021, Carson et al. (2021) found medical mistrust was a prominent theme in vaccine decision making. They conducted 13 focus groups with a total of 70 participants, 24.3% of whom were African American; however, they did not stratify their findings by race/ethnicity.

In a November to December 2020 study of COVID-19 vaccine intentions and

mistrust in a national sample of 207 African Americans, Bogart et al. (2021a) conducted an explanatory factor analysis with varimax rotation on 27 survey items that were derived from prior research studies, to assess COVID-19 vaccine confidence and mistrust beliefs. From this analysis, four subscales were created and found to be significantly correlated with each other ($p < 0.05$ for all). The COVID-19 vaccine mistrust subscale was positively correlated with the government mistrust subscale ($r = 0.48$) and the race-based mistrust subscale ($r = 0.30$), and negatively correlated with the confidence and need subscale ($r = -0.46$); the confidence and need subscale was also negatively correlated with the government mistrust subscale ($r = -0.35$), and the race-based mistrust subscale ($r = -0.29$); and the government mistrust subscale was positively correlated with the race-based mistrust subscale ($r = 0.42$). In preliminary results published of the follow-up interviews conducted by Bogart et al. (2021b) with 18 of the 66 African American participants who endorsed high vaccine hesitancy in the above study, researchers found medical mistrust was attributed to systemic racism, including mistreatment and discrimination in the health care system and by the government.

A December 2020 survey of 779 minority participants, 270 (34.7%) African American, 262 (33.6%) Asian, and 247 (31.7%) Hispanic, indicated that while African Americans did not differ significantly from other minorities in individual-level medical mistrust, they scored significantly higher ($p < 0.001$) than the other two cohorts in group-based medical mistrust (Minaya et al., 2022). The same study also revealed only 50% of African Americans indicated an intention to be vaccinated against COVID-19, a percentage that was significantly lower ($p < 0.001$) than both of the other racial minority groups in the

study. In addition, when Minaya et al. (2022) investigated the relationship between medical mistrust and intention to vaccinate, they found that both individual-level medical mistrust (β = -0.03, p = 0.036) and group-level medical mistrust (β = -0.04, p = 0.017) were significantly negatively associated with intent to vaccinate among African Americans. Overall, participants with higher individual-level medical mistrust had lower intent to vaccinate. However, because this study employed a cross-sectional design and data were collected around the time of EUA of the COVID-19 vaccine, it does not shed any light on whether there were any strategic changes in medical mistrust over time that may have impacted vaccine intention.

Where medical mistrust is high, vaccine confidence is expected to be low, which leads to vaccine hesitancy (MacDonald, 2015). However, some researchers have cautioned excessive focus on individual factors such as hesitancy and medical mistrust may deflect attention away from the need to address key structural determinants of low vaccine uptake, such as racism (Agarwal et al., 2021; Chu & Liu, 2021; Siegel et al., 2021; Stoler et al., 2021). Systemic racism has been identified as a barrier that leads to medical mistrust. In follow-up qualitative interviews conducted in November 2020 and March 2021 with 24 African Americans who expressed low COVID-19 vaccination intentions in an online survey, Dong et al. (2022) found that among the reasons given for vaccine hesitancy were experiences of systemic racism and medical mistrust. Themes that emerged regarding medical mistrust included mistrust of government, mistrust of healthcare providers/systems, mistrust of pharmaceutical industry, mistrust of the vaccine itself, and misinformation/myths about the COVID-19 vaccines.

These themes were also echoed in a January 2021 special webinar of the Roundtable on Black Men and Black Women in Science, Engineering, and Medicine that was convened to address COVID-19 and vaccination concerns in the African American community. Expert panelists agreed questions they had been asked by community members such as "can the vaccine alter my DNA", "can I get COVID-19 from the vaccine itself", and "could the vaccine alter my fertility" reflect real concerns that stem from a lack of answers from trusted, reliable sources (Laurencin et al., 2021, p. 813). These concerns reflect a common refrain among African Americans that they don't want to be human "guinea pigs" for COVID-19 vaccines (Bogart et al., 2021b; Bunch, 2021; Dong et al., 2022; Fisher et al., 2020; Hoffman & Lee, 2020; Ignacio et al., 2022; Jamison et al., 2019; Jones, 2022; Langer Research Associates, 2020; C. A. Latkin et al., 2021b; Laurencin et al., 2021; Madorsky et al., 2021; Opel et al., 2021), a thought which stems from the previously described racially motivated historical experimentation on African Americans.

Nong et al. (2021) conducted an explanatory mixed methods study from May to September 2020 to understand racial differences in attitudes about public health efforts during COVID-19. In the quantitative arm, they analyzed state-level survey data from a representative sample of 1,000 Michigan residents and found that in unadjusted ordinary least squares regression African Americans showed *higher* trust in public health information sources ($b = 0.38$, $p = 0.001$) and *higher* willingness to participate in public health efforts ($b = 0.62$, $p < 0.001$) than Whites. In the adjusted analysis the statistical significance of these relationships disappeared. Nong et al. (2021) then interviewed 26 survey respondents (19 African American, 2 White, 5 other/unknown) to further understand these unexpected

results. Three broad themes emerged as motivations for willingness to participate in public health efforts: altruism (concern for family and community members), risk acknowledgement (awareness of the high mortality among African Americans), and confidence that the public health efforts would help mitigate the spread of COVID-19. While this pre-EUA study focused on information sharing during contact tracing and did not ask about COVID-19 vaccine trial participation or uptake intentions, the findings are still relevant as they suggest COVID-19 worry may play a pivotal role in the decision to follow health behavior recommendations among populations known to have high medical mistrust.

Medical Mistrust and Experiences of Racism

There is a strong connection between medical mistrust and experiences of racial discrimination among African Americans. In addition to the previously described findings of Johnson et al. (2021), A. C. Smith et al. (2021) examined online survey data collected in May 2020 from 963 American adults (24.0% non-Hispanic African American, 22.5% non-Hispanic White) to investigate how race, ethnicity, and experiences of three types of racial discrimination are associated with medical mistrust and COVID-19 protective behaviors. Bivariate correlation analysis showed statistically significant positive associations ($p < 0.001$ for all) between medical mistrust and everyday discrimination ($r = 0.33$), healthcare discrimination ($r = 0.31$), and structural discrimination ($r = 0.28$), and statistically significant negative associations ($p < 0.001$ for all) between COVID-19 protective behaviors and structural discrimination ($r = -0.33$), healthcare discrimination ($r = -0.24$), and everyday discrimination ($r = -0.22$).

A. C. Smith et al. (2021) also found the means and standard deviations were

significantly higher for non-Hispanic African Americans than for non-Hispanic Whites ($p <$ 0.05 for all) for medical mistrust ($M = 3.55$, $SD = 0.76$ versus $M = 3.22$, $SD = 0.80$ respectively) and for healthcare discrimination ($M = 1.99$, $SD = 0.92$ versus $M = 1.58$, $SD =$ 0.80 respectively). However, they found no statistically significant association between medical mistrust and COVID-19 protective behaviors. As with the Nong et al. (2021) data, these data were collected prior to the availability of a COVID-19 vaccine and vaccination was not included among the COVID-19 protective strategies examined by A. C. Smith et al. (2021). Nevertheless, these findings provide further evidence that even when medical mistrust is high among African Americans, this population may be willing to follow public health recommendations in a crisis.

Armstrong et al. (2013) previously studied factors that contribute to racial differences in medical mistrust and found that higher medical mistrust among African Americans was explained by prior experiences of discrimination. They analyzed the results of a telephone survey of a sample of 2,179 adults in 40 metropolitan statistical areas (35.0% African American, 58.1% White) and found that African Americans scored substantially higher on measures of racial discrimination than their White counterparts, with 60% of African Americans reporting experiencing discrimination in three or more settings (out of nine) as compared to 13% of Whites. In the unadjusted regression model, African Americans were more likely to report medical mistrust levels in the upper quartile than Whites (OR 1.47, 95% CI [1.22, 1.78]), and this increased likelihood held when the model was adjusted for health care access (aOR 1.33, 95% CI [1.05, 1.68]), and for sociodemographics and comorbidities (aOR 1.30, 95% CI [1.02, 1.66]). However, when the

model was adjusted for experiences of discrimination, the relationship reversed and African Americans were *less* likely to report medical mistrust levels in the upper quartile than Whites (aOR 0.53, 95% CI [0.33, 0.85]) and at all other levels. These inverse associations between experiences of discrimination and medical mistrust and were not modified by gender, education, or income ($p > 0.4$ for all interaction terms). In this study, adjusting for racial discrimination completely explained the relationship between medical mistrust and race.

A more recent survey of California adults conducted in 2019 yielded similar results. In a sample of 2,328 participants, 30.2% African American, 30.5% Hispanic, and 39.2% White, Bazargan et al. (2021) found that after adjusting for all covariates, multinomial logistic regression revealed the odds of reporting medical mistrust were significantly higher for African Americans as compared with Whites (aOR = 1.73, 95% CI [1.15, 2.61], $p < 0.01$). In addition, experiences of racial discrimination was significantly associated with increased odds of reporting medical mistrust as compared with respondents who reported some trust in providers (aOR = 1.41, 95% CI [1.24, 1.59], $p < 0.001$) and with those who reported lots of trust in providers (aOR = 1.25, 95% CI [1.10, 1.43], $p < 0.001$). While none of the data reported above prove any causal relationships, they are consistent with findings of Benkert et al. (2019a) and Johnson et al. (2021), and they do indicate significant correlations between medical mistrust, African American race, and experiences of racism.

Race-Related Stress

The psychological and emotional stress that is experienced in response to incidents of racism has been called race-based or race-related stress (Carter, 2007; Carter et al., 2016;

Carter et al., 2017; Carter et al., 2013; Carter & Sant-Barket, 2015; Comas-Díaz, 2016; Comas-Díaz et al., 2019; Grills et al., 2016; Laurencin & Walker, 2020; Polanco-Roman et al., 2016; Sibrava et al., 2019; C. P. Smith & Freyd, 2014; Utsey, 1999). Many scholars have likened this psychological response to the post-traumatic stress disorder (PTSD) that is described in the *Diagnostic and Statistical Manual of Mental Disorders* (Anderson et al., 2022; Butts, 2002; Carter et al., 2018; Comas-Díaz, 2016; Comas-Díaz et al., 2019; DeGruy, 2005; Kirkinis et al., 2021; Laurencin & Walker, 2020; Paradies et al., 2015; Polanco-Roman et al., 2016; Sibrava et al., 2019). Race-based stress has also been associated with medical mistrust (Greer et al., 2014) and as discussed above, medical mistrust has been associated with racism.

Racism in America is both interpersonal and systemic, and it is a form of traumatic stress to which African Americans are actively and passively exposed every day (Bazargan et al., 2021; Bogart et al., 2021c; Comas-Díaz et al., 2019; DeGruy, 2005; Hammonds & Reverby, 2019; IOM, 2003; Sexton et al., 2021; C. P. Smith & Freyd, 2014; Williams & Mohammed, 2013). There is a robust and well established literature showing that racism contributes to poorer physical and mental health in African Americans (Bailey et al., 2017; Carter et al., 2017; Carter & Sant-Barket, 2015; Cooper Owens & Fett, 2019; Crear-Perry et al., 2021; Egede & Walker, 2020; Gee & Ford, 2011; Greer et al., 2014; IOM, 2003; Liu & Modir, 2020; Paradies et al., 2015; Pascoe & Richman, 2009; Polanco-Roman et al., 2016; Saban et al., 2021; Sibrava et al., 2019; Thames et al., 2019; Utsey, 1999; Williams et al., 2019; Williams & Mohammed, 2009, 2013; Yearby, 2018). While the research linking racism to poorer health outcomes is solidly established, the multiplicity of ways by which it

does so is less completely fleshed out.

Racial Discrimination and Health

Polanco-Roman et al. (2016) conceptualized racial discrimination as a behavioral manifestation of interpersonal racism and noted such manifestations had a detrimental effect on the mental health of racial minorities. They asserted these blatant displays of race-based mistreatment and the more covert microaggressions experienced by African Americans were chronic in nature and could lead to dissociative symptoms. Dissociation is defined as "momentary lapses from reality in response to a threatening situation that is perceived as emotionally taxing and results from a loss of control over the environment" (Polanco-Roman et al., 2016, p. 611), and the authors reasoned dissociation is an individual's attempt to cope with acute emotional stress. Further, they hypothesized that if individuals experienced racial discrimination as a psychological trauma, perceived discrimination would be positively associated with dissociative symptoms. They tested this theory in a sample of 743 predominantly minority students (34% African American, 30% Asian, 24% Hispanic, 6% White, 6% Other) from a northeastern U.S. university, the majority of whom (69%) reported a history of racial discrimination. One-way ANOVA revealed African Americans had a statistically higher frequency of experiences of discrimination than both Hispanics and Whites ($p < 0.05$) and regression analyses revealed a significant positive association between the frequency of racial discrimination and dissociative symptoms after adjusting for other traumatic life events ($p < 0.01$).

To examine potential mechanisms through which racial discrimination may affect health, Pascoe and Richman (2009) conducted a meta-analysis of 134 articles published

between 1987-2007 containing data related to discrimination and health outcomes. The majority of articles included in their review contained data related to racial discrimination (65.7%), but other types of discrimination represented in the analysis included gender (16.4%), unfair treatment (9.0%), sexual orientation (6.0%), other (4.5%), and in 5.2% of the articles included, the type of discrimination was not specified. The hypothesized model tested by Pascoe and Richman consisted of a direct pathway between perceived discrimination and mental and physical health, a pathway mediated by psychological and physiological stress, and a pathway mediated by health behaviors. After weighting each study for sample size, perceived discrimination was found overall to be significantly and negatively correlated (reported $p < 0.00$) with health behaviors ($r = -0.18$, 95% CI [-0.21, -0.15]), mental health ($r = -0.16$, 95% CI [-0.20, -0.12]), physical health ($r = -0.13$, 95% CI [-0.16, -0.10]), and stress response (both physiological and psychological), which was negatively coded ($r = -0.11$, 95% CI [-0.18, -0.05]). These associations endured even after key demographic covariates were considered in the analysis.

Paradies et al. (2015) conducted a similar, broader meta-analysis of data from 333 articles published in English between 1983-2013 to assess the body of knowledge related to racism as a determinant of mental and physical health outcomes. Unlike Pascoe and Richman (2009), Paradies and colleagues excluded studies that reported types of discrimination other than racial. They also excluded studies that measured race-related stress and health in the same instruments as their goal was to focus on research in which there was a clear delineation between exposure and health outcome as separate constructs, to avoid confounding. Their results showed racism was significantly related ($p < 0.001$) to poorer

mental health. The mean weighted effect size for negative mental health outcomes such as distress, stress, anxiety, and PTSD among others was r = -0.23 (95% CI [-0.24, -0.21], k = 227); and the mean weighted effect size for positive mental health outcomes such as self-esteem, life satisfaction, and wellbeing was r = -0.13 (95% CI [-0.16, -0.10], k = 113). Weaker but significant associations ($p < 0.001$) were found between racism and poorer physical health. Moderators such as age, sex, and education did not significantly affect any of these relationships.

Sibrava et al. (2019) observed the literature suggested the prevalence of PTSD was higher in African Americans and Hispanics than in Whites and that the progression, management, and treatment of PTSD in these minority groups was poor. To further investigate this observation, they conducted a 5-year longitudinal study of 152 African American and 139 Hispanic adults with anxiety disorders to determine whether sociocultural factors and racial stressors were contributors to higher prevalence and poorer outcomes of PTSD. Binary logistic regression revealed between 28.4% and 37.9% of the variation in PTSD diagnosis could be explained by experiences of discrimination ($p < 0.001$). Among African Americans, statistically significant predictors of PTSD included being threatened or harassed (OR = 4.55, 95% CI [1.50, 13.80], $p < 0.007$) and seeing friends treated unfairly (OR = 0.14, 95% CI [0.04, 0.45], $p < 0.001$; this variable was negatively coded such that the OR < 1 predicts a greater likelihood of PTSD). Over 5 years of follow-up, African Americans had a remission rate of 0.35 despite a relatively high rate of treatment utilization. The most frequently reported experiences of discrimination among African Americans with a PTSD diagnosis were seeing friends treated unfairly (56.3%), being personally treated

unfairly (53.1%), and being threatened or harassed at least once a week (40.6%). These findings support the view that both direct and indirect experiences of racism have an emotionally traumatic and chronic impact on African Americans.

In a recent systematic review of the social science literature related to racial discrimination and psychological trauma, Kirkinis et al. (2021) identified and analyzed 28 studies published between 2000-2017. Inclusion criteria included quantitative studies of adults participants conducted in the United States with specific measures of racial discrimination and trauma. Studies were excluded if they used measures of general discrimination or lacked a measure of trauma and/or racism. The vast majority of studies in the review examined direct experiences of discrimination, only four included measures of vicarious or intergenerational racism. Almost half the studies considered trauma in terms of PTSD while others examined dissociative and other experiences related to trauma. Seven studies used a measure that combined racism and trauma. The analysis did not provide mean values for the associations or stratification by race, but Kirkinis and colleagues found that overall, 70% of the associations between racial discrimination and trauma were significantly positive with strengths ranging from $r = 0.10 – 0.68$, 37% of which were above 0.45 and 17% were above 0.50.

Racial Discrimination and COVID-19

A thorough review of the literature failed to identify any studies that examined the correlation between race-related stress and COVID-19 health behavior; however, a limited number of studies have examined the relationship between experiences of racial discrimination and COVID-19. Savoia et al. (2021) explored this relationship in mobile

phone survey data collected in December 2020 from 2,650 individuals from all 50 U.S. states, Puerto Rico, Guam, and American Samoa who were prioritized for vaccination under the EUA. The respondents were 66% White, 14% African American, 8% Hispanic, and 12% other. The outcome variable was likelihood of COVID-19 vaccine uptake, and the predictor variables were past experience of different types of discrimination, risk perception, prior diagnosis of COVID-19, clinical risk of severe consequences from the disease, and job type. Bivariate regression analyses showed African Americans were 1.22 times more likely to report a higher level of vaccine hesitancy than any other racial group (OR = 1.22, 95% CI [1.01, 1.48], $p < 0.05$) and respondents who experienced racial discrimination were significantly more likely to report a higher level of vaccine hesitancy (OR = 1.30, 95% CI [1.12, 1.50], $p < 0.001$). In the multivariable models, racial discrimination was the only variable that was significantly associated with vaccine hesitancy (OR = 1.21, 95% CI [1.01, 1.45], $p < 0.05$); however, the study did not stratify by race those who reported experiencing discrimination.

Siegel et al. (2021) found significant racial disparities in COVID-19 vaccination and determined the magnitude of the African American disparities was strongly associated with structural racism. Reliable data were available and analyzed for 45 states and the investigators identified racial disparities in vaccination as of May 2021 in 43 (96%) of those states. They then used linear regression analyses to explore the relationship between the state-level index of structural racism and the observed racial disparities. This predictor variable was developed by Siegel et al. in previous research and comprises a measure of structural racism across five dimensions: residential segregation, incarceration, educational

attainment, economic indicators, and employment indicators. The resulting state racism index measures structural racism in each of the 50 states on a scale of 0 to 100.

For each 1 SD increase in the state racism index they developed, Siegel et al. (2021) found the African American vaccination rate was 3.15 percentage points lower than the White vaccination rate. After adjusting for vaccine hesitancy and the percentage of Trump votes, 1 SD in the African American state racism index was associated with a 2.87 percentage point increase in vaccination disparity. The authors noted a limitation of this study was that the structural racism index does not include a measure of disparity in access to health care. However, the results support the rationale for studying the relationship between racial stress and COVID-19 vaccination behavior among African Americans.

Zhou et al. (2022) theorized the COVID-19 pandemic would exacerbate the health disparities seen in posttraumatic stress symptoms (PTSS) among people of color (POC) because of the increased burden of the disease borne by this population. They investigated racial disparity in PTSS in data from a July 2020 online survey of 2,019 participants from the United States and Puerto Rico, 58.4% non-Hispanic White/European American, 14.0% Hispanic/Latinx American, 13.8% Black/African American, 6.1% Asian American Pacific Islander, 2.8% Mulitracial, 1.7% Native American and Alaska Native, 0.2% Middle Eastern/Arab American, 0.8% Other, and 2.1% unknown. All known races other than non-Hispanic White were deemed POC (39.4%). Predictor variables included COVID stressors, direct racism, and indirect racism. Other trauma exposure, specifically adverse childhood experiences (ACE), and intimate partner violence (IVP) were also measured to control for confounding by other trauma exposure.

Independent *t*-tests conducted by Zhou et al. (2022) showed significantly higher ($p < 0.001$ for all) PTSS among POC ($M = 1.83$, $SD = 1.74$) as compared to non-Hispanic Whites ($M = 1.48$, $SD = 1.66$), higher COVID stressors among POC ($M = 2.03$, $SD = 0.84$) than non-Hispanic Whites ($M = 1.74$, $SD = 0.92$), higher direct racism among POC ($M = 1.29$, $SD = 1.22$) than non-Hispanic Whites ($M = 0.71$, $SD = 1.04$), and higher indirect racism among POC ($M = 2.33$, $SD = 0.77$) than non-Hispanic Whites ($M = 1.75$, $SD = 0.98$). Sub-group ANOVA found direct racism was significantly higher ($p < 0.001$ for all) among African Americans ($M = 1.43$, $SD = 1.28$) as compared to Hispanics ($M = 1.13$, $SD = 1.16$) and Whites ($M = 0.69$, $SD = 1.02$), and indirect racism was significantly higher ($p < 0.001$ for all) among African Americans ($M = 2.45$, $SD = 0.74$) as compared to Asian American Pacific Islanders ($M = 2.08$, $SD = 0.83$) and Whites ($M = 1.73$, $SD = 0.98$). Bivariate correlation revealed PTSS was significantly associated ($p < 0.001$) with COVID stressors ($r = 0.45$), direct racism ($r = 0.39$), indirect racism ($r = 0.30$), and race ($r = 0.10$), all of which were also significantly associated with one another ($p < 0.001$).

After controlling for age, gender, parent status, education, income, ACEs, and IPV, Zhou et al. (2022) found PTSS racial disparity was explained more by direct racism and indirect racism than by COVID stressors. Standardized path estimates comparing African Americans to Whites showed only the indirect effect of race on PTSS that was mediated by direct racism was statistically significant ($R^2 = 0.051$, 95% CI [0.033, 0.074], $p < 0.001$). Taken together, these results underscore the detrimental impact of racism on African Americans during the COVID-19 pandemic.

Measures of Race-Related Stress

To measure in a multidimensional manner the racial stress to which African Americans are commonly and daily subjected, Utsey and Ponterotto (1996) developed the Index of Race-Related Stress (IRRS), a 46-item instrument that assesses experiences of racism on four subscales: cultural, institutional, individual, and global racism. In 1999, Utsey developed and validated a shorter version of the scale called the IRRS-Brief (IRRS-B) that was based on a tripartite model of cultural (10 items), institutional (6 items), and individual (6 items) racism. Over the ensuing two decades, the IRRS and IRRS-B became the most widely used instruments to measure racial stress among African Americans.

In 2007 another instrument to measure race-related stress was developed, this one focused not on the daily and habitual African American experiences of racism but on exploring the effects of a specific memorable racial encounter (Carter, 2007). The Race-Based Traumatic Stress Symptom Scale (RBTSSS) is a 52-item instrument with seven subscales of emotional symptoms: avoidance, hypervigilance, intrusion, depression, anger, physical reactions, and low self-esteem (Carter et al., 2018). The RBTSSS instructs respondents to recall up to three memorable experiences of racism in their lives and then fill out the survey questions based on the most memorable event. The RBTSSS is less well suited to the purposes of my proposed research because of its focus on a single specific racist encounter as opposed to the daily and chronic experiences of racism in multiple domains that is measured in the IRRS-B.

In their study of systemic racism as a moderator of the effects of provider racial bias on adherence to recommended treatment and medical mistrust among African American

hypertension patients, Greer et al. (2014) used the IRRS-B to measure systemic racism and the GBMMS to measure medical mistrust. They hypothesized high levels of systemic racism would be associated with poor adherence to treatment and increased medical mistrust relative to perceived provider racial bias. Findings indicated race-related stress was significantly and positively correlated with perceived provider racial bias and medical mistrust ($p < 0.001$ for both) and regression analysis showed the predictors of treatment adherence accounted for 17% of variance ($p < 0.05$). Regression line slope analysis revealed the slopes for mean race-related stress and low race-related stress were both significant from zero ($\beta = -0.35$, $p < 0.01$ and $\beta = -0.54$, $p < 0.001$ respectively).

Cruz and Palmer (2015) used a quasi-experimental design to examine the relationships between race-related stress as measured by the IRRS-B and physical health disorders among African American and Hispanic college students. A total of 60 participants were enrolled: 37 reported their racial identity as Black, 8 as White, and 15 as Other; regarding ethnicity, 35 identified as African American, 24 as Hispanic/Latino, and 1 student self-identified as both. On the day of the study, researchers collected baseline samples of salivary cortisol (a measure of physiological stress) from participants before showing them a film with non-stimulating scenes and having them complete a demographic questionnaire. After a second salivary cortisol sample was collected, students were exposed to a film depicting racist scenes. After the second film, participants were administered the IRRS-B and the Subjective Health Complaints Inventory (SHI) and researchers collected a third salivary cortisol sample.

A repeated measures MANOVA was performed by Cruz and Palmer (2015), and

they found a statistically significant difference ($p < 0.05$) in cortisol levels after exposure to the racist film ($M = 0.140$, $SD = 0.089$) as compared to the cortisol levels after the neutral film ($M = 0.069$, $SD = 0.069$) and the baseline levels ($M = 0.078$, $SD = 0.099$). There was no significant difference between the baseline levels and levels after the neutral film. A correlation matrix was calculated to determine the relationships between the measures of race-related stress, health, and the three cortisol levels. Significant positive associations were found between IRRS-B global racism and SHI allergy and flu symptoms ($p < 0.05$), between IRRS-B institutional racism and SHI allergy and flu symptoms ($p < 0.01$), and between IRRS-B individual racism and SHI allergy ($p < 0.01$). No significant correlations were found between measures of race-related stress, health complaints, and cortisol levels.

The IRRS-B was also used in a recent pilot study of the potential for a race-related stress reduction intervention to decrease the psychobehavioral and inflammatory risk associated with cardiovascular disease among African American women (Saban et al., 2021). Although preliminary, results indicated the intervention could be effective in promoting better coping strategies for chronic racism. This research suggests that if an association were found between race-related stress and COVID-19 vaccine hesitancy, reduction in that stress might be a strategy for attenuating vaccine hesitancy.

Summary and Conclusions

There is ample empirical evidence of African American COVID-19 vaccine hesitancy in the literature (Bunch, 2021; Khubchandani et al., 2021; C. A. Latkin et al., 2021a; McElfish et al., 2021; K. H. Nguyen et al., 2021; Rane et al., 2022), and that trust is a strong and independent determinant of vaccine hesitancy (Freimuth et al., 2017;

MacDonald, 2015). Most recent literature suggests that hesitancy is fueled by the novelty of the disease, speed of vaccine development, concerns about vaccine safety, and medical mistrust (Badr et al., 2021). The literature also suggests that while many African Americans are vaccinated against COVID-19, uptake is delayed, lagging behind that of White Americans even when there is access. It is important to understand the reasons for this delay as it could have relevance not only for this pandemic, but for future public health crises as well.

Individual factors that negatively impact vaccination rates include African American medical mistrust grounded in structural and interpersonal experiences of racism and discrimination (Artiga et al., 2020; Bogart et al., 2021a, 2021b; Ferdinand et al., 2020; Jones, 2022; Khubchandani & Macias, 2021; L. H. Nguyen et al., 2022). Though the correlation was weak, it is noteworthy that decreased participation in healthy behaviors and/or increased participation in unhealthy behaviors was the most influential significant pathway by which discrimination impacts health outcomes (Pascoe & Richman, 2009). Experiences of individual, institutional, and cultural racism can produce stressful psychological discomfort that has been labelled race-based or race-related stress (Carter & Sant-Barket, 2015; Chapman-Hilliard et al., 2020; Liu & Modir, 2020; Polanco-Roman et al., 2016; Sibrava et al., 2019; Utsey, 1999).

While both medical mistrust and race-related stress are well documented in the literature, the relationship between the two has not been well explored. Many studies have examined the racial disparities in COVID-19 vaccination, and many have identified the role of psychosocial determinants in vaccine hesitancy, but few studies have looked at the

association with racial stress. Many studies have also examined the influence of COVID-19 worry on vaccine hesitancy and uptake, but none could be found that considered that variable in combination with racial stress. Evidence has been presented in this chapter of strategic trust during times of crisis and of the pivotal role risk perception plays in health decision-making among populations with high medical mistrust yet there is little evidence examining the relationship between medical mistrust, COVID-19 worry and COVID-19 vaccine uptake among African Americans, a population that has been shown to have both high medical mistrust and high risk for more severe COVID-19 outcomes. This study will fill a gap in the literature by examining the association between race-related stress, medical mistrust, COVID-19 worry and COVID-19 vaccine behavior variables through the lens of the HBM and TPB. In the next chapter, *Methodology*, I will explain the research design to be used in my study, the rationale for its use, and how it relates to the research questions.

Chapter 3: Research Method

The purpose of this investigation was to examine factors that influence COVID-19 vaccination behavior among African Americans. In this chapter, I restate the research questions and hypotheses and explain the research design used, the rationale for its use, and how it was related to the research questions. I provide details about the study population, sampling, and recruitment. The sources for the survey items and the justification and permission for their use in my survey instrument are thoroughly described, and the parameters of the pilot study that was conducted prior to broad data collection are presented. I clarify how each variable was operationalized and measured, describe in detail the data analysis that was used to answer each research question, and explain how the findings would be interpreted. Finally, the threats to validity are discussed as are the ethical considerations and procedures applicable to my study.

Research Design and Rationale

As described in Chapter 1, the RQs are:

- RQ 1: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?
- RQ 2: Is there a relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?

- RQ 3: Is there a relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?
- RQ 4: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?
- RQ 5: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States?
- RQ 6: Is there a relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States?
- RQ 7: Is there a relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States?

- RQ 8: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States?

The predictor variables in this study were race-related stress, medical mistrust and COVID-19 worry and the outcome variables were COVID-19 vaccine hesitancy and COVID-19 vaccine uptake. The control variables were age, gender, education, and income. Because the objective of this study was to test hypotheses and measure the associations between multiple variables without manipulating any of them, a non-experimental, observational, correlational, quantitative design was warranted (Creswell & Creswell, 2018).

Due to time and budget constraints that I faced as a doctoral student, a longitudinal design, such as a cohort study was deemed impractical. Another type of observational design that was considered was a case-control study which would compare African Americans who are vaccinated with those who are not. However, because COVID-19 vaccines had been available for over 2 years, a group of individuals who were still unvaccinated may have contained other influencing characteristics not examined or controlled for in this study, such as being opposed to all vaccines or having an intense fear of needles. Instead, I employed a cross sectional design. This was an appropriate choice because it could be done relatively quickly and inexpensively; it required data collection from only a single point in time, and this strategy had been commonly used to examine determinants of health (Wang & Cheng,

2020). The research design was suitable to advance knowledge in the field of public health because COVID-19 is a new disease in which racial disparities have been observed; identifying and calculating associations that influence those disparities in a quantitative correlational study is an important contribution to the pursuit of health equity.

Methodology

Population

The target population for this study was self-identified non-Hispanic African American adults aged 18 years or older living in the United States. According to the U.S. Census Bureau (n.d.), of the approximately 331.9 million Americans in 2021, 13.6% identified their race as Black or African American alone; however, because Hispanics may be of any race, Hispanic African Americans were included in that 13.6%. The U.S. Department of Health and Human Services (HHS) Office of Minority Health (OMH) reported that in 2019 there were 40.6 million non-Hispanic African Americans in the United States (OMH, 2021), and in 2021 there were reportedly 31.7 million (9.6%) non-Hispanic African American adults (Kids Count Data Center, 2022).

Sampling and Sampling Procedures

A non-probability, voluntary response, convenience sample was drawn from MTurk. Although convenience samples lack the clearer generalizability of (more cost-prohibitive) probability samples, researchers can be more confident in the generalizability of homogeneous convenience samples, those limited to specific sociodemographic characteristics (Jager et al., 2017). They contended the narrower the sampling frame the lower the chance of bias in convenience sampling relative to the target population. Given the

budget constraints and the circumscribed population being explored, this sampling strategy was deemed suitable for this study.

MTurk is an online crowdsourcing labor market created by Amazon.com in 2005 that has been increasingly used for data collection in public health research in general (Casey et al., 2017; Créquit et al., 2018; Nadler et al., 2021; Walters et al., 2018), and in COVID-19 research specifically (L. M. Hill et al., 2022; Khubchandani et al., 2021; C. Latkin et al., 2022; C. A. Latkin et al., 2021b, 2021c; A. C. Smith et al., 2021). Investigators (requesters) can post surveys (human intelligence tasks [HITs]) in MTurk for paid participants (workers) to choose to complete. The site host, Amazon Web Services (AWS), claims MTurk has 500,000 workers across 200 countries (personal communication via email, December 6, 2022); however, AWS does not disclose more specific demographic information about MTurk workers. While some have questioned the number of workers cited by AWS, independent research by Difallah et al. (2018) suggested there are at least 100,000 MTurk workers, 75% of whom are in the United States, and approximately 2,000 of whom are active at any given time.

A meta-analytic review of MTurk demographics across three separate samples indicated MTurk gender demographics approximate the general U.S. population; however, African Americans appeared to be slightly underrepresented at approximately 8% (Burnham et al., 2018; Nadler et al., 2021). U.S. MTurk workers also tend to be younger, better educated, more likely to be under- or unemployed, and report a lower personal income than the general population (Difallah et al., 2018; Nadler et al., 2021; Walters et al., 2018). These differences were similar to those observed between other online samples and the general

population (Casey et al., 2017; Kimball, 2019).

Although MTurk workers are paid relatively little, on average approximately 14 cents per hour (Horton et al., 2011), participants can still be readily and rapidly recruited. For example, Buhrmester et al. (2011) offered 2 cents for a 30-minute task and were able to recruit 25 participants in 5 hours of posting time and increasing the pay to 50 cents for the same 30-minute task resulted in 25 participants in 2 hours of posting time. Upon comparison, they found that compensation rates did not affect the quality of the data, which was overall high. They collected surveys at three different compensation levels in a set of six personality questionnaires and found the absolute levels of the mean alphas ranged from $\alpha = 0.73 – 0.93$, and across the three compensation levels, the mean alphas were within one hundredth of a point of each other. Buhrmester et al. concluded that MTurk workers are not financially motivated but internally motivated, for instance by enjoyment. Taking all this into consideration, I offered 50 cents to MTurk workers who agreed to complete my 20-minute questionnaire.

Sample Size

Laerd Statistics (n.d.) recommends a minimum of 15 cases for each independent variable, which would result in a minimum sample size of 105 for this study. However, others recommended as many as 50 cases per independent variable (Laerd Statistics, n.d.). Given these parameters, I set a goal to collect a minimum of 105 responses for analysis and to close the survey after I hit a target of 300 responses overall.

Recruitment, Participation, and Data Collection

Primary data were collected via an online survey that was posted to the MTurk site.

Participation was voluntary and those who wished to respond to the HIT first answered a set of screening questions. Inclusion criteria were:

1. Living in the United States
2. Race is African American
3. Ethnicity is non-Hispanic
4. Age is 18 years or older

Exclusion criteria for the study were:

1. Have previously completed the survey
2. Living outside the United States
3. Race other than Black or African American
4. Hispanic ethnicity
5. Minor under the age of 18 years

The race and ethnicity categories used in the screening questions were the same as those currently used by the U.S. Census Bureau.

As stated, my goal was to obtain 300 responses. Based on the findings that there are at least 75,000 MTurk workers in the United States (Difallah et al., 2018) and that 8% of them (6,000) are African American (Burnham et al., 2018; Nadler et al., 2021), I needed a response rate of approximately 5.8% to achieve that goal. Only one survey from each individual worker identification (ID) number was included in the analysis. When more than one survey was received from a unique worker ID only the first survey completed in full was accepted.

Pilot Study

After I received Walden University Institutional Review Board (IRB) approval of my research (approval #06-28-23-0055843), I conducted a pilot study to test the data collection process of using a Qualtrics link on the MTurk platform and to assess the average time to complete the survey. The survey instrument in Appendix A was used to create a questionnaire in Qualtrics and a link to the Qualtrics survey was posted on the MTurk Worker website. Any individual registered as a Worker on MTurk was able to log into to the MTurk Worker site and see a list of HITs available for their consideration. My HIT was called a "COVID-19 Vaccination Survey."

When setting up my HIT on MTurk, in the systems qualifications section, I limited the MTurk worker location to the United States and in the HIT visibility section, I selected "private," meaning MTurk workers located anywhere in the world could see my HIT listed, but only those located in the United States could preview and possibly select my HIT to complete. Workers who were able to preview my HIT saw the following description in the preview: "The purpose of this survey is to collect information about factors that influence COVID-19 vaccination behavior among African American adults." MTurk workers interested in participating in my research were directed to click on a link that took them to my survey in Qualtrics.

Once in the Qualtrics survey, MTurk workers were first required to complete a set of pre-screen questions. If a potential participant did not meet the study criteria, they were not allowed to proceed further in the survey. If they did meet the qualifications for inclusion, the next screen they saw was the consent form. At the end of the consent form, potential

respondents were asked: “Do you consent to participate in this study?” Only if they clicked “Yes” were they allowed to complete the full survey. After they completed the survey, Qualtrics gave the MTurk worker a unique survey completion code which they were required to enter into MTurk before they submitted the HIT for review. The submitted MTurk record included the MTurk worker’s ID, the unique Qualtrics survey completion code, and some statistics about the date, time, and duration of the HIT, but it did not include the responses to the pre-screen question or the survey questions; this information was only included in the Qualtrics data, which did not include the MTurk worker ID.

By convention (Connelly, 2008), the number of pilot participants is equal to 10% of the number of participants required for the study. Therefore, I collected 11 pilot responses and assessed the overall data collection process and average time to complete the surveys. Because no issues were identified, I proceeded to full data collection without making any changes to the protocol and all pilot surveys were considered for inclusion in the final analysis.

Instrumentalization and Operationalization of Constructs

The study questionnaire was developed after performing a thorough review of validated instruments, subscales, and individual items used in published research to measure the constructs of interest. The survey comprised a combination of established instruments plus one original question. When feasible for the purposes of this study, the pre-screen questions and demographic questions (used for statistical purposes only) reflected wording used in published research. The final instrument contained 47 items (not including the pre-screen questions), and participants were advised in the consent that the survey would take

approximately 20 minutes to complete (see Appendix A).

Race-Related Stress

The independent variable race-related stress was measured using the Index of Race-Related Stress Brief version (IRRS-B). The IRRS-B is a shorter version of the 46-item Index of Race-Related Stress (IRRS), an instrument developed by Utsey and Ponterotto (1996) to measure the everyday stress and psychological discomfort that result from African Americans' experiences of racism in this country. The 22-item IRRS-B was developed by Utsey (1999) and is based on a tripartite model of individual racism (six items), institutional racism (six items), and cultural racism (10 items). Each item describes an instance of discrimination, and the response key is a 5-point Likert scale with the following values:

0 ___ This never happened to me

1 ___ This event happened, but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

In a sample of 239 African Americans aged 16-91 years recruited from the community-at-large, an urban substance abuse program, and a private Catholic university in the Northeast United States, Utsey (1999) found the reliability of the subscales as measured by Cronbach's α for internal consistency to be 0.78 for both cultural and individual racism and 0.69 for institutional racism. Construct validity was measured using an aggregate-item confirmatory factor analysis and the goodness-of-fit index for the tripartite model was 0.92. In addition, Utsey examined the differences in Black and White Americans' endorsement of

the items on the IRRS-B and found that Blacks scored much higher than Whites on all three subscales: individual racism *M (SD)* = 13.16 (6.49) and 5.87 (5.13) respectively, $p < .001$; institutional racism *M (SD)* = 10.23 (5.90) and 6.00 (6.24) respectively, $p < .001$; and cultural racism *M (SD)* = 28.96 (7.19) and 13.35 (10.66) respectively, $p < .001$.

For the past two decades the IRRS and IRRS-B have been the most widely used instruments to measure racial stress among African Americans (Chapman-Hilliard et al., 2020). The IRRS-B was appropriate to use in my study because it provided a succinct multidimensional measure of the racial stress to which African Americans are commonly and daily subjected, and racism has been associated with COVID-19 vaccine hesitancy (Savoia et al., 2021; Siegel et al., 2021). In this study, a global racism score with a possible range of 0-88 was calculated by adding the subscale scores and that global score was used as the measure of race-related stress. Higher scores indicated more experiences of racism and increased stress in response to those experiences. A license (#1314174-1) to use the IRRS-B was granted by the Copyright Clearance Center (CCC) on January 20, 2023, on behalf of the publisher, SAGE Publications, Inc. (see Appendix B).

Medical Mistrust

As discussed in Chapter 2, the three most widely used scales to measure medical mistrust are the Group Based Medical Mistrust Scale (GBMMS), the Medical Mistrust Index (MMI), and the Health Care System Distrust Scale (HCSDS). In this study, the independent variable medical mistrust was measured using the GBMMS as adapted by Johnson et al. (2021). The GBMMS was chosen because when examining the object and referent of medical mistrust for the GBMMS, MMI, and HCSDS, Williamson and Bigman (2018)

found that for the GBMMS the referent was a group and the object for most items was system/personal, i.e., the scale assessed whether members of a racial group distrusted medical systems and personnel. This perspective of medical mistrust was the most relevant to my study.

The GBMMS is a 12-item scale that was developed by Thompson et al. (2004) and initially validated in a group of 168 urban African American and Latina women aged 18 years and older. The instrument measures suspicion of healthcare professionals, of medical treatment provided to members of the respondent's racial or ethnic group, and of mainstream healthcare systems, and the internal consistency is high at $\alpha = 0.83 – 0.87$ (Benkert et al., 2009a). Responses are keyed on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and four items in this instrument (numbered 24, 30, 32, and 32 in my survey) are reverse coded for scale. Since its development, the GBMMS has been validated in several other populations as well, including urban African American men aged 40-75 years, Cronbach's $\alpha = 0.87$ (Shelton et al., 2010), and mixed gender community-dwelling African American adults aged 25-91 years, Cronbach's $\alpha = 0.87$ (Benkert et al., 2009a).

The GBMMS was also validated by Johnson et al. (2021) in their study of correlates of medical mistrust among 165 minority women (103 Black and 62 non-Black) at risk for HIV. The researchers modified the GBMMS scale slightly by replacing the words "ethnic" or "ethnicity" with "racial" or "race" in each item and they reported a Cronbach's $\alpha = 0.89$ for the internal consistency of their amended instrument. This wording was more suitable for my study than the original wording since I was focused on race and not ethnicity.

Permission to use the GBMMS as administered by Johnson et al. (2021) was granted by the CCC on January 31, 2023, on behalf of the publisher, SAGE Publications, Inc. (see Appendix C).

COVID-19 Worry

The independent variable COVID-19 worry was operationalized as COVID-19 fear and anxiety and was measured using the Fear of COVID-19 Scale (FCV-19S) as adapted by Perz et al. (2022). The FCV-19S was developed and initially validated by Ahorsu et al. (2020) in a sample of 717 Iranian adults aged 18 years or older to measure individual fears, worries, and anxiety related to COVID-19. The scale was developed in stages, the first consisting of a compilation of 28 items identified from previously validated scales on fear, the second consisting of expert review and evaluation of those 28 items by a general physician, nurse, virologist, psychiatrist, and health psychologist, resulting in the retention of 17 items. The third stage comprised a second expert evaluation by a pulmonologist, social psychologist, health education specialist, and sociologist and resulted in the deletion of 7 more items, and the final stage was a pilot study of the 10-item scale that included telephone based cognitive interviews with the pilot participants to explore their thoughts about and responses to each item.

After analysis, Ahorsu et al. deleted three more items because of low corrected item-total correlations resulting in a final scale comprising seven items with a Cronbach's α = 0.82 for internal consistency. Concurrent validity of the FCV-19 S was also assessed and supported by the Persian version of the Hospital Anxiety and Depression Scale (HADS) and the Persian version of the Perceived Vulnerability to Disease Scale (PVDS) both of which

demonstrated significant correlations of $p < 0.001$ (Ahorsu et al., 2020). FCV-19S answers are keyed on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) with a total score range from 7-35, the higher the score the greater the fear of COVID-19.

Though the prototype scale was developed and tested in Persian, the resulting manuscript was originally published in English and the FCV-19S was subsequently translated and validated in several other languages and national settings (Muller et al., 2021) including several non-American English-speaking populations (Bellamkonda & Pattusamy, 2022; Lin et al., 2021; Winter et al., 2023). The FCV-19S was recently validated by Perz et al. (2022) in sample of 237 U.S. undergraduate and graduate students aged 18-60 years from a small public university. Perz et al. changed the wording from the original authors' translation of two of the survey items to avoid confusion and misinterpretation by an American cohort and tested the internal consistency reliability of their revised instrument. They found excellent internal consistency as evidenced by Cronbach's $\alpha = 0.91$ and very high corrected item-total correlations of $r \geq 0.70$ for all seven items. They also explored construct validity by examining the relationship between the FCV-19S and Generalized Anxiety Disorder-7 (GAD-7) and found a significant moderate correlation between the two, $r = 0.68$, $p < 0.001$. Finally, participants who scored higher on the GDA-7 had significantly higher total scores on the FCV-19S ($p < 0.001$), providing evidence of convergent validity.

The Perz et al. (2022) findings supported a correlation between the FCV-19S and anxiety and when Muller et al., (2021) conducted a systematic review of studies that evaluated instruments that measure fear or phobia of COVID-19, a meta-analysis revealed the FCV-19S total score correlated moderately with anxiety. In addition, in their study of

functional fear as a predictor of public health compliance during the COVID-19 pandemic, Harper et al. (2021) found many of the items on the FCV-19S to be relevant to anxiety. For these reasons, the FCV-19S was deemed an appropriate instrument to measure the variable COVID-19 worry, operationalized as fear and anxiety in my research. Permission to use the FCV-19S as modified and validated by Perz et al. (2022) was granted by the lead author on February 21, 2023 (see Appendix D).

Control Variables

In addition to the predictor variables race-related stress, medical mistrust, and COVID-19 worry, I planned to control for age, gender, education, and income. in the analyses. These covariables were identified based on the review of the literature which suggested each of these demographic characteristics could influence COVID-19 vaccination behavior and confound the relation between the predictor variables and outcome variables (King et al., 2021; Kriss et al., 2022; C. A. Latkin et al., 2021a; McElfish et al., 2021; Rane et al., 2022). These control variables were treated as independent variables in the statistical analyses and were measured using items from previously published COVID-19 studies.

COVID-19 Vaccine Hesitancy

The dependent variable COVID-19 vaccine hesitancy was measured with an original item that asked respondents if they intentionally delayed getting the COVID-19 vaccine (yes or no). Instructions specified that intentional delay meant the individual purposely did not get a first shot as soon as they were eligible because they did not want the vaccine or did not want to get it yet. It was not related to issues of access but rather to the desire to be or not to be vaccinated if a vaccine were made immediately available.

COVID-19 Vaccine Uptake

The dependent variable COVID-19 vaccine uptake was measured with an item derived from the National Health Interview Survey (NHIS), an instrument developed by the HHS in 1957 that serves as the principal data collection tool for the CDC's National Center for Health Statistics (NCHS) to monitor the nation's health (CDC, 2022a). Each year the NCHS uses geographically clustered sampling techniques to gather cross-sectional household data about approximately 30,000 adults and 9,000 children in the civilian, noninstitutionalized American population via face-to-face and telephone interviews (CDC, 2022a). In addition to core and rotating content related to a wide range of health topics, each year the NHIS includes questions about emerging public health concerns (CDC, 2022a). My research included a COVID-19 vaccination question from the *IMS: Immunization with 2022 Supplements* section of the Adult Module of the 2022 NHIS to assess COVID-19 vaccine uptake. This item was appropriate for use in my study because it was used by the CDC in a national survey examining the same variable. Because NHIS was developed by the federal government, it is in the public domain and permission is not required to use this question in my study (Hathcock, 2022).

Data Analysis Plan

After all the data were collected, they were initially exported from Qualtrics as an Excel-compatible XLSX file, and initial data analysis (IDA) was carried out in Microsoft Office Excel version 365 software as described below. After initial IDA, the final dataset was imported into the IBM Statistical Package for the Social Sciences (SPSS) version 28 software for analysis. Prior to statistical analysis, the assumptions for binomial logistic

regression were assessed to confirm this statistical test was valid for my dataset.

Initial Data Analysis

IDA is important to identify and address any shortcomings in the data that could impact the results of the research (Huebner et al., 2020; Njeri-Otieno, n.d.). Data cleaning consists of checking for and correcting errors in the data, and data screening consists of reviewing the data properties to identify any that do not conform to assumptions made to develop the analysis plan (Huebner et al., 2020; Njeri-Otieno, n.d.). The IDA for this study was initially carried out in Excel.

No errors in the data were corrected, instead a decision was made to exclude from final analysis any case that had one or more missing data elements, an invalid date of birth, suspected bot activity, or an excessively short amount of time to complete the survey. The medical mistrust items that required reverse coding for scale were reverse coded and a new variable was calculated for the mean medical mistrust score for each case. The individual item scores for the race-related stress questions were summed in each record to calculate the total race-related stress. Likewise, the individual item scores for the FCV-19S questions in the survey were summed in each record to calculate the total COVID-19 worry. Finally, the age in years of each respondent was calculated based on the date of birth.

After this initial IDA in Excel, the dataset was imported into SPSS for further IDA and statistical analysis. Additional screening consisted of reviewing data properties to identify any that did not conform to assumptions made to develop the analysis plan (Huebner et al., 2020). In variable view, I made sure each variable was correctly characterized as either string or numeric and verified the label values for the variables were

correctly coded. Finally, I looked at the frequencies in descriptive statistics to explore the minimum, maximum, mean, and standard deviation of the values to be sure they were appropriate and logical.

Assumption Testing

After IDA was complete, the assumptions for the statistical analysis were tested. The statistical analysis that was performed to answer each RQ was binomial logistic regression. There are seven assumptions that had to be met for this statistical test to be valid (Laerd Statistics, n.d.):

1) the dependent variables had to be dichotomous,
2) there had to be one or more independent variables that could be either continuous or categorical,
3) there had to be independence of observations and the categories of the dependent variable and nominal independent variables needed to be mutually exclusive and exhaustive,
4) there had to be a large enough sample size to draw valid conclusions from the fitted model,
5) a linear relationship was required between any continuous independent variables and the logit transformation of the dependent variable,
6) there could be no multicollinearity in the data that indicated the predictor variables were highly correlated with one another, and
7) there could be no unusual points such as outliers, high leverage points, or highly influential points in the data.

The first 3 assumptions were satisfied by the design of the study and the 4th was satisfied by the rule of thumb for the minimum sample size required (Laerd Statistics, n.d.). The only continuous independent variable was age; therefore the 5th assumption was tested by using the Box-Tidwell approach to test for a linear relationship between age and the logit of COVID-19 vaccine hesitancy and COVID-19 vaccine uptake (Laerd Statistics, n.d.). When age was found to violate the assumption of linearity, I applied a transformation to that covariable to try to correct the problem (Laerd Statistics, n.d.).

The 6th assumption that there be no multicollinearity was tested by examining the correlation coefficients and Tolerance/VIF values in SPSS. Research reviewed in Chapter 2 indicated there is some correlation between race-related stress and medical mistrust, however a strong correlation had to be present for the 6th assumption to be violated. A correlation coefficient of ≥ 0.5 or a VIF between 5 and 10 would indicate a strong correlation between two variables and the only remedy for this violation would have been to eliminate one of the highly correlated variables from the analysis (Laerd Statistics, n.d.). Finally, the 7th assumption was tested by running a case wise diagnostic during the regression. When the Z residual in the case wise list was > 2.5 or < -2.5, that indicated outliers and a decision was made to either keep or remove from analysis cases with those values.

Statistical Analysis

The relationship between the predictor variables race-related stress, medical mistrust, and COVID-19 worry and each of the outcome variables COVID-19 vaccine hesitancy and COVID-19 vaccine uptake was examined by conducting binomial logistic regressions. This

test is used to predict the probability of a dichotomous outcome based on two or more explanatory variables (Laerd Statistics, n.d.; Warner, 2013). The parameters used in this analysis are summarized in Appendix E. Bivariate logistic regressions were run with each one of the independent variables and each one of the dependent variables to answer RQs 1, 2, 3, 5, 6, and 7. Following that, a multivariable logistic regression was run with all the independent variables and each of the dependent variables to address the first hypothesis of RQs 4 and 8. Finally, a multivariable logistic regression was run with all the predictor variables and control variables and each of the outcome variables to address the second hypothesis of RQs 4 and 8.

The results of the statistical analysis were interpreted by examining the SPSS output. The odds ratio and 95% confidence interval for each of the independent variables in the bivariate analyses was reported if they were significant at $p \leq 0.05$. The null hypothesis was rejected, and the alternative hypothesis was accepted, if the model chi-squared X^2 in the omnibus tests of model coefficients had a significance of $p \leq 0.05$. The amount of variance explained by the model was assessed by examining the Cox and Snell R^2 and the Nagelkerke R^2 in the model summary output. The chi-squared X^2 in the Hosmer and Lemeshow test in the SPSS output was examined to determine the model fit. Finally, the contribution of each predictor variable to the model was assessed both with and without the control variables, with a 95% confidence interval and a statistical significance set at $p \leq 0.05$. Significant contributions were reported in terms of an odds ratio and an adjusted odds ratio.

Threats to Validity

Internal validity is the extent to which a study design can support the claim that a

change in the independent variables is responsible for an observed change in the dependent variables and external validity is the extent to which the conclusions drawn in a study are generalizable to a broader context (Laerd Dissertation, 2012b, 2012c; Price et al., 2017). Since there is no manipulation of the variables in nonexperimental correlational designs, they tend to have lower internal validity and tend to have higher external validity when the study sample is similar to the population to which the conclusions will be generalized (Price et al., 2017). There are eight main threats to internal validity: history, maturation, instrumentation, testing, selection bias, regression to the mean, social interaction/desirability, and attrition bias (Bhandari, 2022). Because this research relied on self-reported behaviors, it was vulnerable to social desirability which was mitigated by making the survey anonymous. This study also asked respondents about their attitudes and behaviors at the time COVID-19 vaccines first became available and was therefore subject to recall bias. This was perhaps the most significant threat, and it is discussed in detail in the Limitations section of Chapter 5. In addition, there are other individual factors that could influence COVID-19 vaccine hesitancy, such as pre-existing vaccine hesitancy or fear of needles, that were not accounted for in this study.

Two of the main threats to external validity to which this study may have been vulnerable are sampling bias and situation effect (Laerd Dissertation, 2012b). As discussed above, though the TMurk workforce is similar in demographic characteristics to other online survey populations, it is not a fully representative sample so there may have been some sampling bias. A situational bias was that respondents were limited to those with access to computers or smart phones and who were comfortable filling out online surveys.

Construct validity is an overarching term that speaks to how well a measuring tool assesses the concept it aims to quantify, and it incorporates other forms of validity including content validity, face validity, and criterion validity (Bhandari, 2022; Laerd Dissertation, 2012a). Because COVID-19 is still a novel disease, there are few validated measures for COVID-related behaviors and attitudes (C. A. Latkin et al., 2021c), such as intentional delay of vaccination. As an original item was used to assess this variable, an inexact or inadequate definition of this behavior was a threat to construct validity.

Statistical validity considers the appropriate statistical treatment of data and addresses the question: based on the data, is there an association between the variables (Glen, 2023; Price et al., 2017)? Some factors that can threaten the soundness of the statistical conclusions include low statistical power, using the wrong tests to analyze the data, and violating the assumptions of the tests used (Glen, 2023; Price et al., 2017). To avoid these threats, I collected more than the minimum number of responses required by the 15-case per independent variable rule of thumb and I tested all the assumptions for multivariable binomial logistic regression prior to analyzing the data.

Ethical Procedures

When using surveys to collect data, there are two important ethical considerations, informed consent and maintaining scientific integrity, and each of these considerations reflects four ethical tenets: autonomy, beneficence, non-malfeasance, and justice (Hammer, 2017). An informed consent page preceded the survey instrument. It described the purpose of the survey, the target audience, the expected time to complete the questionnaire, and the anticipated MTurk compensation. In addition, participants were informed that their

participation was voluntary, their responses were anonymous, there were no foreseeable risks or benefits of their participation, and they could choose to exit the survey at any time. While I did not collect participant contact information, I did provide respondents with my Walden email address in case they wished to contact me about the study. Hitting "next" after reading the informed consent page constituted consent.

The scientific integrity of the study was maintained by only soliciting participation from adults with the decisional capacity to answer the survey questions. Almost all of the questionnaire consisted of previously validated survey items and the instrument was piloted. Every effort was made to mitigate bias. The anonymity of the participants was always maintained by me, and the data were stored on my private password protected laptop to ensure confidentiality. Only my committee members and I had access to the data. By practice, AWS removes the HIT and corresponding data from MTurk accounts after 120 days (MTurk, n.d.) and on November 30, 2023, I confirmed that all data from the pilot study and full data collection had been removed. Lastly, in addition to adhering to the ethical tenets of autonomy, beneficence, non-malfeasance, and justice, all 40 of the ethical standards espoused by the Walden University IRB were met in this research study.

Summary

This research used a quantitative, cross-sectional, correlation design to examine factors that influence COVID-19 vaccination behavior among African Americans. The predictor variables were race-related stress, medical mistrust and COVID-19 worry; the outcome variables were COVID-19 vaccine hesitancy and COVID-19 vaccine uptake; and the covariates for which I controlled were age, gender, education, and income. Data was

collected via MTurk and the survey instrument was pilot tested prior to data collection. Binomial logistic regression was used to answer the research questions and test the hypotheses. I report the results of the pilot test and statistical analyses in Chapter 4.

Chapter 4: Results

The purpose of this investigation was to examine factors that influence COVID-19 vaccination behavior among African Americans by examining the role that experiences of racism and concern about the disease played in whether and when a sample of African Americans decided to be vaccinated against COVID-19. The predictor variables in this study were race-related stress, medical mistrust, and COVID-19 worry, and the outcome variables were COVID-19 vaccine hesitancy and COVID-19 vaccine uptake. The control variables were age, gender, education, and income.

There were eight research questions: three looked at the relationship between each one of the three predictor variables with the outcome variable COVID-19 vaccine hesitancy, three looked at the relationship between each one of the three predictor variables with the outcome variable COVID-19 vaccine uptake, and two looked at the relationship between a model containing all three of the predictor variables and each one of the outcome variables. The 10 hypotheses tested the presence of a significant relationship between the combinations of predictor and outcome variables described above, and when I examined the correlations between the model and the outcome variables, I planned to test for a significant relationship both with and without the control variables. The research questions are detailed in this chapter before the corresponding results/tables. In this chapter I report the results of the pilot study and describe aspects of data collection. I provide descriptive statistics of the sample and discuss how representative it is of the population of interest. Finally, I report the findings of the statistical analyses that addressed each of the eight research questions and that determined the acceptance or rejection of the null hypotheses.

Pilot Study

The pilot study began on July 1, 2023, with the goal of collecting 11 valid responses, called HITs in MTurk. Because the survey was hosted on Qualtrics, the MTurk HITs did not include the actual survey data, only a unique survey code which the respondents received in Qualtrics after completing the survey. Once 11 HITs were submitted in MTurk, the pilot study was paused, and the HITs were reviewed. One of those HITs was rejected because it contained an invalid Qualtrics survey code, so the pilot study was resumed. After another HIT was received and accepted, the pilot study was closed on July 1, 2023, and the corresponding Qualtrics survey data were inspected. No issues with the data collection process were identified, and the average time to complete the survey was within 5 minutes of the time estimated in the consent form. Based on these results, no changes were made to the data collection strategy or the survey instructions, and the accepted pilot study surveys were included for consideration in the study analysis.

Data Collection

Ultimately, data for this research were collected in two phases not including the pilot. The first phase of full data collection began on July 02, 2023. Any MTurk HIT with an invalid Qualtrics survey code was rejected, and after reaching the goal of 300 accepted responses, the initial phase of MTurk data collection was closed on July 3, 2023. The Qualtrics survey data for the pilot study and Phase 1 data collection were then downloaded into Microsoft Excel and reviewed. After data cleaning, only 88 of the 311 pilot and Phase 1 surveys were accepted for inclusion in the data analysis. Because this fell short of the minimum requirement of 107 surveys, a second round of data collection began on MTurk on

July 11, 2023 and closed on July 12, 2023 after the goal of 300 accepted MTurk responses had been met. The Qualtrics data for Phase 2 data collection were downloaded into Microsoft Excel and reviewed. After cleaning, 100 additional surveys were accepted for inclusion in the data analysis, for a total of 188 surveys. Questions 24, 30, 32, and 34 related to medical mistrust were reverse coded for scale and initial IDA was performed before the final dataset of 188 cases was exported from Microsoft Excel into SPSS for analysis.

Reasons for exclusion from analysis included duplicate MTurk identification numbers (in which cases only the first survey submitted by the respondent was included in the analysis), missing survey data element(s), invalid date of birth, suspected bot activity, and excessively short amount of time to complete the survey. In the Qualtrics survey, I activated the Bot Detection setting. This setting helps determine if a survey response is from a human or a bot. When enabled, the Bot Detection setting adds to the survey data a Q_RecaptchaScore field that uses Google's invisible reCAPTCHA technology to give each response a score between 0-1. A score $\geq$ 0.5 means the respondent is likely a human and a score < 0.5 means the respondent is likely a bot (University of Illinois Technology Services, 2023). All surveys with Q_RecaptchaScores of 0 to 0.4 were excluded from analysis, as were surveys that were completed in less than 5 minutes. Because the survey comprised 47 items and instructions before each block, I questioned the reliability of surveys completed in < 5 minutes. Table 1 shows the total number of surveys collected in each stage and the number of surveys excluded from analysis for each of the reasons mentioned above. Overall, 31% of the HITs accepted in MTurk were included in the data analysis.

Table 1

Data Collection Summary

Collection Stage	HITs Accepted	In Final Analysis	% of Accepted	Reasons for Exclusion from Analysis				
				Duplicate ID#	Suspected BOT	Missing Data	Invalid DOB	Time to Complete
Pilot	11	7	64%	0	0	3	1	0
Phase I	300	81	27%	2	22	93	34	68
Phase II	300	100	33%	30	18	82	23	47
Totals	611	188	31%	32	40	178	58	115

Descriptive Statistics

The sample population included in the analysis was 59% male, and the mean age was 32.4 years, ranging from 18 years to 62 years with a standard deviation of 11.0 and the 75th percentile was 39.5 years. Regarding education and income, 93.1% of the sample possessed a bachelor's degree as their highest education and another 3.2% possessed a graduate degree; 66.5% had an annual income of $35,000-$69,999 and 29.3% reported an income of $70,000 or more. Based on these descriptive statistics, the sample population was considerably higher educated than the general African American population; 97.9% of the sample had a bachelor's degree as compared to only 22.6% of the general African American adult population (Postsecondary National Policy Institute, 2023). While no per capita income data could be found for African Americans, in 2021 the median household income for single race non-Hispanic African Americans was $45,300 (Moslimani et al., 2023), suggesting the sample population may also have had a higher income than the general African American population.

Concerning the predictor variables in the sample, race-related stress was normally

distributed with a mean global racism score of 2.23 and range of 0.59 to 3.68 as measured on a 5-point Likert scale of 0 (this never happened to me) to 4 (this event happened and I was extremely upset), the higher the score the higher the race-related stress. The distribution of the medical mistrust data was extremely skewed towards the higher values (-1.002), with a mean score = 3.22, mode = 3.42, and range of 1.92 to 3.92 on a 5-point Likert scale of 1 (strongly disagree) to 5 (strongly agree). The distribution of the COVID-19 worry data was also extremely skewed towards the higher values (-1.054) with a mean total score = 27.11, mode = 28, and a possible score range from 7-35, the higher the score the greater the fear of COVID-19. Table 2 summarizes the descriptive characteristics of the sample by the predictor variables.

Table 2

Descriptive Characteristics of Sample by Predictor Variables

Demographic	Sample Totals		Mean RRS	Mean MM	Mean Worry
	#	%	(0-4)	(1-5)	(7-35)
Total Sample	188	100.0	2.23	3.22	27.11
Male	111	59.0	2.20	3.25	26.97
Female	77	41.0	2.27	3.19	27.31
Education					
Less than HS diploma	0	---	---	---	---
HS diploma/GED	3	1.6	1.73	3.03	22.33
Some college/associate degree	1	0.5	1.45	2.25	10.00
Bachelor's degree	175	93.1	2.25	3.24	27.33
Some post graduate school	3	1.6	1.82	3.11	25.33
Graduate degree	6	3.2	2.30	3.17	26.83
Annual Income in USD					
<35,000	8	4.3	2.24	3.28	26.50
35,000-69,999	125	66.5	2.14	3.21	26.88
≥70,000	55	29.3	2.43	3.25	27.73

Table 3 summarizes the descriptive characteristics of the sample by the outcome variables. For the outcome variables, of the 188 respondents included in the final analysis,

87 (46.3%) endorsed an intentional delay of vaccine uptake, but only 4 (2.1%) reported being unvaccinated. Of the 4 respondents who were unvaccinated: all were men; 1 had a HS diploma/GED education and 3 had a bachelor's degree; and 1 made at least $70,000 while 3 made between $35,000-$69,999.

Table 3

Descriptive Characteristics of Sample by Outcome Variables

Demographic	Vaccine Hesitant				Vaccinated			
	Yes		No		Yes		No	
	#	%	#	%	#	%	#	%
Total Sample	87	46.3	101	53.7	184	97.9	4	2.1
Male	54	48.6	57	51.4	107	96.4	4	3.6
Female	33	42.9	44	57.1	77	100.0	0	0.0
Education								
Less than HS diploma	0	---	0	---	0	---	0	---
HS diploma/GED	2	66.7	1	33.3	2	66.7	1	33.3
Some college/associate degree	1	100.0	0	---	1	100.0	0	---
Bachelor's degree	79	45.1	96	54.9	172	98.3	3	1.7
Some post graduate school	2	66.7	1	33.3	3	100.0	0	---
Graduate degree	3	50.0	3	50.0	6	100.0	0	---
Annual Income in USD								
<35,000	6	75.0	2	25.0	8	100.0	0	---
35,000-69,999	59	47.2	66	52.8	122	97.6	3	2.4
≥70,000	22	40.0	33	60.0	54	98.2	1	1.8

Further review of the descriptive statistics revealed respondents who were vaccine hesitant had lower mean race-related stress scores, higher mean medical mistrust scores, and higher mean COVID-19 worry scores than those who were not. Although similar differences in scores were found for vaccination status, the number of unvaccinated individuals in the sample was too small for these differences to be given much consideration. Table 4 summarizes the mean predictor variable scores for each outcome variable.

Table 4

Predictor Variable Means for Each Outcome Variable

	Vaccine Hesitant			Vaccinated		
	Yes	No	mean	Yes	No	mean
	n = 87	n = 101	difference	n = 184	n = 4	difference
Mean RRS	2.19	2.26	-0.07	2.22	2.40	-0.18
Mean MM	3.24	3.21	0.03	3.23	3.02	0.21
Mean Worry	3.90	3.85	0.05	3.88	3.54	0.34

Results of Analysis

Test of Assumptions

Prior to analyzing the relationships in the research questions, I tested the assumptions for logistic regression. The first four assumptions were satisfied by the design of the study and the sample size included in the analysis. I used the Box-Tidwell procedure to test for linearity between the continuous independent variables and the logit of each of the dependent variables. This assumption was met for the all the continuous independent variables and the logit of COVID-19 vaccine uptake; however, age, the only continuous control variable, was not linearly related to the logit of the outcome variable COVID-19 vaccine hesitancy. Even after applying a Bonferroni correction, age still violated this assumption with regards to COVID-19 vaccine hesitancy. Consequently, I determined to remove the control variable age from the analysis of the relationship of the model to the outcome variable COVID-19 vaccine hesitancy.

To test the sixth assumption of no multicollinearity, the tolerance/VIF values in the coefficients table were examined and were found to be the same for both dependent variables. All the tolerance values were greater than 0.1 (the lowest was 0.326) and all the

VIF values were much lower than 10 (the highest was 3.066), indicating the sixth assumption of was met. The seventh assumption was tested by running case-wise diagnostics during the binomial logistic regressions and the results are reported with the results of the analysis for each RQ in the following section.

Research Questions

The statistical analysis I performed to answer each of the research questions was binomial logistic regression with OR and 95% CI. For RQs 1, 2, 3, 5, 6, and 7, I conducted bivariate logistic regressions, and for RQs 4 and 8, I conducted multivariate logistic regression with adjusted ORs and 95% CI.

Research Question 1

RQ1 was "Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine hesitancy, measured endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States?" The case-wise diagnostic run during the analysis to test the seventh assumption of logistic regression indicated there were no outliers in the data and that it was appropriate to proceed with interpretation of the results. Bivariate logistic regression revealed no significant relationship between race-related stress and COVID-19 vaccine hesitancy (OR = 0.992, 95% CI [0.971, 1.013]). Therefore, the null hypothesis was accepted, and the alternative hypothesis was rejected, meaning there is no relationship between race-related stress and COVID-10 vaccine hesitancy.

Research Question 2

RQ2 was: Is there a relationship between medical mistrust, measured by the Group

Based Medical Mistrust Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States? The case-wise diagnostic run during the analysis to test the 7th assumption of logistic regression indicated there were no outliers in the data and that it was appropriate to proceed with interpretation of the results. Bivariate logistic regression revealed no significant relationship between race-related stress and COVID-19 vaccine hesitancy (OR = 1.019, 95% CI [0.944, 1.099]). Therefore, the null hypothesis was accepted, and the alternative hypothesis was rejected, meaning there is no relationship between medical mistrust and COVID-10 vaccine hesitancy.

Research Question 3

RQ3 was: Is there a relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States? The case-wise diagnostic run during the analysis to test the 7th assumption of logistic regression indicated there were no outliers in the data and that it was appropriate to proceed with interpretation of the results. Bivariate logistic regression revealed no significant relationship between race-related stress and COVID-19 vaccine hesitancy (OR = 1.026, 95% CI [0.946, 1.113]). Therefore, the null hypothesis was accepted, and the alternative hypothesis was rejected, meaning there is no relationship between COVID-19 worry and COVID-10 vaccine hesitancy.

Research Question 4

RQ4 was: Is there a relationship between race-related stress, measured by the Index

of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States? RQ4a looked at these relationships without the control variables. The case-wise diagnostic run during the analysis to test the 7th assumption of logistic regression indicated there were no outliers in the data and that it was appropriate to proceed with interpretation of the results.

In the first multivariate logistic regression run without the control variables, the omnibus test of model coefficients revealed no significant relationship between the predictor variables and the outcome variable COVID-19 vaccine hesitancy ($X^2 = 1.640$), and no significant relationship between any of the predictor variables race-related stress, medical mistrust, and COVID-19 worry (OR = .987, 95% CI [0.964, 1.011]; OR = 1.018, 95% CI [0.934, 1.109]; and OR = 1.036 95% CI [0.944, 1.138] respectively), and the outcome variable. The poor fit of the model was further confirmed by the Hosmer and Lemeshow test which was significant ($X^2 = 22.349$, $p = 0.004$). This model explained between 0.9% to 1.2% of the variation in COVID-19 vaccine hesitancy based on the Cox & Snell R^2 and Nagelkerke R^2 respectively. As a result of these findings, the first null hypothesis was accepted and the alternative hypothesis was rejected, meaning there is no relationship between race-related stress, medical mistrust, COVID-19 worry, and COVID-19 vaccine hesitancy. Table 5 illustrates the results of the multivariate logistic regression that was performed for RQ4a.

Table 5

RQ4a Multivariate Logistic Regression

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
IV1 RRS	-0.013	0.012	1.181	1	0.277	0.987	0.964	1.011
IV2 MM	0.018	0.044	0.165	1	0.684	1.018	0.934	1.109
IV3 Worry	0.036	0.048	0.554	1	0.457	1.036	0.944	1.138
Constant	-1.163	1.615	0.519	1	0.471	0.312		

RQ4b looked at the relationship between all the predictor variables and the outcome variable COVID-19 vaccine hesitancy when controlling for the covariables. To test the second null hypothesis that there is no relationship between race-related stress, medical mistrust, COVID-19 worry, and COVID-19 vaccine hesitancy, when controlling for age, gender, education, and income, I ran the multivariate analysis again and included the control variables. However, because the covariable age did not meet the 5th assumption of linearity, it was excluded from the model. The case-wise diagnostic run during the analysis to test the 7th assumption of logistic regression indicated there was one outlier in the dataset (*ZResid* = -2.016), however, because the value was not < -2.5, it was not excluded from the analysis per the plan proposed in Chapter 3.

In the second multivariate logistic regression, the omnibus test of model coefficients revealed no significant relationship between the predictor variables and outcome variable COVID-19 vaccine hesitancy when controlling for gender, education, and income (X^2 = 10.110), and no significant relationship between any of the predictor variables race-related stress, medical mistrust, and COVID-19 worry (OR = .990, 95% CI [0.966, 1.014]; OR = 1.017, 95% CI [0.931, 1.112]; and OR = 1.081 95% CI [0.975, 1.198] respectively), and

COVID-19 vaccine hesitancy. However, the Hosmer and Lemeshow test for this model was not significant ($X^2 = 4.037$). This model explained between 5.2% to 7.0% of the variation in COVID-19 vaccine hesitancy based on the Cox & Snell R^2 and Nagelkerke R^2 respectively. Based on these results, the second null hypothesis was accepted, and the alternative hypothesis was rejected, meaning there is no relationship between race-related stress, medical mistrust, COVID-19 worry, and COVID-19 vaccine hesitancy when controlling for covariates. Table 6 illustrates the results of the logistic regression that was performed for RQ4b when controlling for gender, education, and income.

Table 6

RQ4b Multivariate Logistic Regression with Control Variables

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
IV1 - RRS	-0.010	0.013	0.670	1	0.413	0.990	0.966	1.014
IV2 - MM	0.017	0.045	0.144	1	0.705	1.017	0.931	1.112
IV3 - Worry	0.078	0.052	2.201	1	0.138	1.081	0.975	1.198
CoV2 Gender (1)	-0.302	0.314	0.925	1	0.336	0.739	0.400	1.368
CoV3 Educ			0.993	4	0.911			
CoV3 Educ (1)	22.845	40192.969	0.000	1	1.000	8343888978.307	0.000	
CoV3 Educ (2)	-0.411	1.409	0.085	1	0.771	0.663	0.042	10.490
CoV3 Educ (3)	0.819	1.873	0.191	1	0.662	2.269	0.058	89.072
CoV3 Educ (4)	-0.372	1.602	0.054	1	0.817	0.690	0.030	15.943
CoV4 Income			3.055	2	0.217			
CoV4 Income (1)	-1.128	0.914	1.521	1	0.217	0.324	0.054	1.943
CoV4 Income (2)	-1.511	0.944	2.563	1	0.109	0.221	0.035	1.403
Constant	-0.742	2.084	0.127	1	0.722	0.476		

This multivariate analysis also showed no significant relationship between gender, education, and income and COVID-19 vaccine hesitancy. These results prompted me to run a univariate analysis with each of the control variables and I found that in my sample, there was no significant relationship between age, gender, education, or income and the outcome

variable COVID-19 vaccine hesitancy (OR = 1.019, 95% CI [.993, 1.047]; OR = .792, 95% CI [.441, 1.421]; OR = .931, 95% CI [.498, 1.742]; OR = .633, 95% CI [.361, 1.108] respectively), even though each of these variables have been associated with COVID-19 vaccine hesitancy in the literature.

Research Question 5

RQ5 was: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States? The case-wise diagnostic run during the initial bivariate logistic regression to test the 7th assumption of logistic regression indicated there were 4 outliers in the data with *ZResid* values ranging from -6.071 to -7.074. Therefore, these 4 cases were removed, and the analysis was run again. The second regression revealed the 4 outlier cases that had been removed were the 4 respondents who were not vaccinated, resulting in the dependent variable having only one value, rendering the binary logistic regression an inappropriate statistical test for the modified dataset. Therefore, the null hypothesis that there is no relationship between race-related stress and COVID-19 vaccine uptake could not be tested with this dataset.

Research Question 6

RQ6 was: Is there a relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States? The case-wise diagnostic run during the bivariate logistic regression to test the 7th

assumption of logistic regression indicated the same 4 cases identified to be outliers in RQ5, the 4 unvaccinated respondents, were outliers in RQ6 with *ZResid* values ranging from -5.323 to -8.517. Because removal of these cases from the analysis would result in the dependent variable having only one value which would render binary logistic regression an inappropriate statistical test for the modified dataset, the null hypothesis that there is no relationship between medical mistrust and COVID-19 vaccine uptake could not be tested with this dataset.

Research Question 7

RQ7 was: Is there a relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States? The case-wise diagnostic run during the bivariate logistic regression to test the 7th assumption of logistic regression indicated the same 4 cases identified to be outliers in RQ5 and RQ6 were also outliers in RQ7 with *ZResid* values ranging from -4.731 to -7.759. Therefore, for the same reasons described above, the null hypothesis that there is no relationship between COVID-19 worry and COVID-19 vaccine uptake could not be tested with this dataset.

Research Question 8

RQ8 was: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States? RQ8a looked at these

relationships without the control variables. The case-wise diagnostic run during the multivariate logistic regression to test the 7th assumption of logistic regression indicated the same 4 cases identified to be outliers in RQ5, RQ6, and RQ7 were also outliers in RQ8a with *ZResid* values ranging from -3.455 to -9.634. Therefore, for the same reasons described above, the first null hypothesis that there is no relationship between race-related stress, medical mistrust, COVID-19 worry, and COVID-19 vaccine uptake could not be tested with this dataset.

RQ8b looked at the relationship between all the predictor variables and the outcome variable COVID-19 vaccine uptake when controlling for the covariables. To test the second null hypothesis that there is no relationship between race-related stress, medical mistrust, COVID-19 worry, and COVID-19 vaccine uptake when controlling for age, gender, education, and income, I ran the multivariate logistic regression again and included all the control variables. The case-wise diagnostic included in the analysis to test the 7th assumption of logistic regression indicated 3 of the same 4 cases identified as outliers in RQ5, RQ6, RQ7 and RQ8a were also outliers in RQ8b with *ZResid* values ranging from -3.546 to -6.525. Because removal of those 3 cases would result in a dataset with only 1 unvaccinated respondent and 184 vaccinated respondents, this dataset was deemed inappropriate to use to adequately test the second null hypothesis that there is no relationship between race-related stress, medical mistrust, COVID-19 worry, and COVID-19 vaccine uptake when controlling for age, gender, education, and income.

Summary

The logistic regression analyses conducted to answer the first 4 research questions in

this study revealed none of the predictor variables, race-related stress, medical mistrust, or COVID-19 worry, either alone or in combination, were significantly associated with COVID-19 vaccine hesitancy. This lack of correlation held true even when controlling for age, gender, education, and income. Because of the composition of my sample, I was unable to test the relationship between the predictor variables, either alone or in combination, and COVID-19 vaccine uptake. My sample also did not demonstrate the association between the covariables age, gender, education, and income and COVID-19 vaccine uptake that has been previously documented in the literature. In Chapter 5 I interpret the implications of these findings, discuss the limitations of this research, explore the impact it may have on social change, and make recommendations for further research that might stem from these results.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative correlational investigation was to examine factors that might influence COVID-19 vaccination behavior among African Americans. This study was conducted because data show racial disparities exist in COVID-19 (Asare et al., 2020; CDC, 2023a; L. Hill & Artiga, 2022), and unvaccinated individuals are at increased risk of infection, severe illness, and death from the disease (CDC, 2022e; Ndugga et al., 2022). African Americans have at times demonstrated the lowest intention to be vaccinated (Khubchandani & Macias, 2021; Niño et al., 2021) and lowest vaccination rates (Kriss et al., 2022; Ndugga et al., 2022; Rane et al., 2022; Siegel et al., 2021) of all racial/ethnic groups in the United States. Identifying factors that contribute to COVID-19 vaccination behavior in this population has the potential to help mitigate the racial disparities seen in this disease.

Results of logistic regression analyses in this study showed no significant relationship between race-related stress, medical mistrust, or COVID-19 worry and COVID-19 vaccine hesitancy. There was also no significant relationship between the model containing all three predictor variables and COVID-19 vaccine hesitancy. This lack of omnibus correlation was maintained even when controlling for gender, education, and income. Although I planned to also control for age, it was excluded from the analysis because it violated the assumption of linearity. In this sample, as age increased the log odds of vaccine hesitancy did not increase by a steady amount. Another unexpected finding in this study was that the sample was 97.9% vaccinated against COVID-19. Consequently, I was unable to test for a significant relationship between any of the predictor variables race-related stress, medical mistrust, or COVID-19 worry and the outcome variable COVID-19

vaccine uptake due to the lack of unvaccinated cases in the sample.

Interpretation of the Findings

Comparison to Other COVID-19 Vaccine Hesitancy Research

In this study, 46.3% of the respondents were vaccine hesitant, which is consistent with the rate of hesitancy found by many other researchers in the first year of vaccine distribution to the general population. In a systematic review of national COVID-19 vaccine hesitancy studies conducted from February 2020 to February 2021, Khubchandani and Macias (2021) found that African American vaccine hesitancy was 41.6%. Findings from this investigation are also consistent with research that indicates COVID-19 vaccine hesitancy is not a significant predictor of vaccine uptake (Agarwal et al., 2021; Chu & Liu, 2021; Siegel et al., 2021; Stoler et al., 2021).

However, the results of the present study are inconsistent with the 13 studies Khubchandani and Macias reviewed (pooled n=107,841), which showed major predictors of African American vaccine hesitancy included experiences of racism and medical mistrust. Medical mistrust was also associated with African American COVID-19 vaccine hesitancy in research by Bogart et al. (2021a, 2021b, 2021c), Thompson et al. (2021), and Dong et al. (2022). However, in the 3 Bogart et al. studies, the only measure of education reported was the percentage of participants who had a high school education or less, which ranged from 13% - 23% across the studies as compared to 1.6% in my cohort. In Dong et al.'s study, 42% of the participants had less than a bachelor's degree as their highest educational attainment compared to only 2.1% in my sample. It is possible that medical mistrust and experiences of racism were not significant predictors of hesitancy in this investigation

because of the higher educational attainment of the participants; 97.9% of this sample possessed a college degree.

In data collected in December 2020 from a national sample of 2,650 participants, 54.6% of whom had a college degree and 14% of whom were non-Hispanic Black, Savoia et al. (2021) found that overall respondents who experienced racial discrimination were significantly more likely to report a higher level of vaccine hesitancy (OR = 1.30, 95% CI [1.12, 1.50], $p < 0.001$). However, the study did not stratify by race those who reported experiencing discrimination. In data collected from June to December 2020, Thompson et al. (2021) found that Blacks had higher vaccine uptake rejection (β [SE] = 0.51 [0.08], $p < 0.001$) compared to the overall mean rejection rate, and that medical mistrust partially mediated this relationship (β [SE], 0.07 [0.02]; $P < .001$). Their sample consisted of 1,835 adults in Michigan, 21% of whom were Black, and the researchers controlled for age, gender, education, income, and essential worker status. As in my study, Thompson et al. (2021) measured medical mistrust using the GBMMS and got a mean score of 2.35 among Blacks, as compared to the mean medical mistrust score of 3.22 in my sample. There may be some interaction between higher education, medical mistrust and vaccine uptake underlying these disparate results.

Findings in this study are also at odds with some other COVID-19 literature. In a national survey of 2,022 individuals, 20.0% of whom were Black/African American, Willis et al. (2023b) found the odds of vaccine hesitancy were significantly greater for African Americans (OR = 1.68, 95% CI [1.18, 2.39], $p = 0.004$) and they were significantly greater for every one unit increase in lifetime experiences of racial discrimination (OR = 1.04, 95%

CI [1.02, 1.05], $p < 0.001$). However, overall, only 37% of their sample had a college education or higher and compared to those with a college degree, those with less education were found to have higher odds of vaccine hesitancy.

Concerning the relationship between vaccine hesitancy and uptake, Rane et al. (2022) found African Americans to be significantly more likely to be COVID-19 vaccine delayers (aOR = 1.99, 95% CI [1.47, 2.71], $p < 0.001$) and the most likely to be vaccine refusers (aOR = 2.53, 95% CI [1.78, 3.59], $p < 0.001$) among all racial groups. Overall, in July 2021, Rane et al. (2022) found a strong and significant association between vaccine hesitancy (as reported in the month prior to receiving the vaccine) and vaccine uptake; however, only 63.6% of the Rane et al. cohort had a college degree. The present study found no association between hesitancy and uptake. The eventual vaccination of those in this study who endorsed intentional delay is consistent with the findings of Willis et al. (2023c), who in April and July of 2021, administered a survey to 1,475 individuals in Arkansas during the 15 minutes wait time after they received a COVID-19 vaccine. They found that 76% of the vaccinated African Americans survey endorsed some degree of hesitancy about receiving the vaccine. Shortly after, in July 2021, Willis et al. (2023a) collected data from 350 Black adults in Arkansas, 32.5% of whom had at least a college degree and found 51.1% of their sample endorsed some level of hesitancy. Approximately 60% of their sample also reported one or more experiences of racial discrimination as compared to 100% of my sample (race-related stress minimum score > 0).

To the best of my knowledge no published studies have specifically examined the relationship between race-related stress and COVID-19 health behavior. In this research, the

mean score for race-related stress was 2.23 on a scale of 0–4 where 0 meant the respondent had never experienced the racial discrimination described in that question. The scores ranged from 0.59–3.68, indicating everyone in this sample had some experience of racism. Yet the mean score fell between 2 (this event happened, and I was slightly upset) and 3 (this event happened, and I was upset). In other research that used the IRRS-B to measure experiences of racism among African Americans, Greer et al. (2014) found a mean score of 1.53 (where 1 = this event happened but did not bother me) in a sample of 100 respondents, 24.0% of whom had some college or professional training. Saban et al. (2021) evaluated the benefit of a race-based stress reduction program among 76 Black women, 40.6% of whom had a college degree, and found a mean score of 2.07 among the control group (n = 36). Shell et al. (2021) used the IRRS-B in their study of burnout among a national sample of 250 Black mental health therapists, 100% of whom had at least a master's degree, and found a mean score of 2.27. Thus, among African Americans as the level of education increases so do levels of race-related stress.

In their recent examination of pathways linking experiences of racial discrimination to COVID-19 vaccine hesitancy in a sample of 242 Black American men from poor communities in the rural South, Curtis et al. (2023) used structural equation modeling to determine discrimination was indirectly associated with hesitancy via endorsement of COVID-19 conspiratorial beliefs. The association between experiences of discrimination and conspiratorial beliefs was weakened by increased levels of perceived social support. In their study, educational attainment was significantly negatively correlated with COVID-19 vaccine hesitancy (r = -0.28, $p < 0.01$).

Roughly half of my study sample endorsed hesitancy, yet only negligible differences were found between those who were hesitant and those who were not in terms of education, mean scores for race-related stress, medical mistrust, and COVID-19 worry, or vaccine uptake. Because my sample was overwhelmingly vaccinated (97.9%), I was unable to make any observations about the differences between those who were vaccinated and those who were not. However, in a mixed methods study of 30 purposefully sampled Black Americans, 16 vaccinated, 14 unvaccinated, Cunningham-Erves et al. (2023) did examine and compare COVID-19 attitudes, communication, and vaccination decision making processes between the vaccinated and the unvaccinated. There were no notable differences between the two groups in terms of age (mean overall approximately 40 years), or education (approximately ¾ of both groups had a college education or higher); however, the vaccinated group tended to have a slightly higher household income. Of the 14 unvaccinated individuals, 11 (78.6%) stated they were delaying vaccination, but nine (81.8%) of the delayers indicated they would likely initiate vaccination in the next 12 months. These findings of plans among the majority of the hesitant to eventually get vaccinated resonate with my study. Similarly, Parameswaran et al. (2023) explored the facilitators and barriers of COVID-19 vaccine uptake in a purposeful sample of 58 African American adults, 35 (60%) of whom were vaccinated. In their sample, more of those who were unvaccinated reported a lower household income (< $75,000) than those who were vaccinated (72% vs. 50% respectively, $p = 0.0002$). Compared to vaccine rejectors, vaccine acceptors scored significantly higher on COVID-19 knowledge questions (65% vs. 95% respectively, $p = 0.018$), and expressed more concern for their community (65% vs. 89% respectively, $p = 0.04$). A limitation of

their study is that it did not ask participants about educational attainment. Parameswaran et al. also did not explore vaccine hesitancy in their cohort; however, Cunningham-Erves et al. did, and they discovered that COVID-19 vaccine hesitancy existed on a continuum from vaccine refusal, to delay, to accept with doubts, to accept with no doubts.

Comparison to Other COVID-19 Vaccine Uptake Research

According to the CDC, by the end April 2021, the first month of COVID-19 vaccine availability to the general public, uptake was only 46.3% among African Americans compared to 59.0% among White Americans (Kriss et al., 2022). By November 2021 that racial disparity had all but disappeared as approximately 78% of both groups had groups had received at least 1 dose of the vaccine (Kriss et al., 2022). Studies published more recently of national and state level data have reported African American COVID-19 vaccination rates to be between 51% (Martin et al., 2023) and 88% (Alcendor et al., 2023). In an online survey of a representative sample (n = 12,757) of Black (13.1%) and White (86.9%) Americans conducted in March-April 2021, Martin et al. (2023) found 51.1% of Black respondents had received at least 1 COVID-19 vaccine. A telephone survey (dates of survey not reported) of 1,984 New Jersey adults, 518 (26.1%) of whom were Black or African American found the COVID-19 inoculation rate among this racial group to be 58.3% (B. Kim et al., 2023). In their study of social and structural determinants of COVID-19 vaccine uptake, Peña et al. (2023) found that in a sample of 12,288 adults living in the United States (18.6% Black) surveyed from May to June 2021, 66.2% of those who self-identified as Black had received at least 1 dose of COVID-19 vaccine.

In their study of racial discrimination, social disadvantage, and racial-ethnic

disparities in COVID-19 vaccine uptake, that analyzed data collected in the spring of 2021 from 10,256 registered voters in California, Haro-Ramos et al. (2023) found that 66.7% of the 608 individuals who self-identified as Black had received at least 1 dose of the COVID-19 vaccine. In other state level survey data, collected in North Carolina from August-September 2021, Lloyd et al. (2023) found the vaccination rate among African Americans to be 86.1%. Alcendor et al. (2023) surveyed a sample of 1,482 individuals from medically underserved communities in Tennessee from October 2021 to June 2022, and found that of the 903 individuals who identified as Black and answered the question about vaccination status, 88.0% had received at least 1 COVID-19 vaccine.

Among those who had not received a vaccine in the Alcendor et al. (2023) study, the reasons endorsed for their decision included distrust in vaccine safety and efficacy, and concerns about side effects. Vaccine hesitant participants in my sample also endorsed medical mistrust, although there was no significant association between medical mistrust and hesitancy. Approximately 98% of participants in my study possessed a college or graduate degree as compared to approximately 28% of participants in the Alcendor et al. (2023) study who held similar degrees. A. C. Smith et al. (2021) also found no statistically significant association between medical mistrust and COVID-19 protective behaviors. However, their data were collected prior to the availability of a COVID-19 vaccine and vaccination was not included among the COVID-19 protective strategies examined in their study. Lloyd et al. (2023) examined the association between trust in public health agencies who recommend vaccination and COVID-19 vaccine status among 1,157 African American adults and found that lower trust significantly decreased the odds of vaccination ($p = 0.05$).

Study participants who were unwilling to be vaccinated or unsure had the highest levels of race-based COVID-19 mistrust while those who were vaccinated had the lowest level. They also found that more unvaccinated respondents than vaccinated reported less than a college education, and more vaccinated participants than unvaccinated endorsed being very concerned about getting COVID-19.

Further, Nong et al., (2021) found evidence in the literature of what they called "strategic trust," a trust that in the context of a public health crisis may operate uniquely from how it functions in other contexts. This suggests that even when medical mistrust is high among African Americans, it might be suppressed or overridden in the face of a life-threatening COVID-19 pandemic in which the risk of serious illness and death is higher for them. In their study of African American COVID-19 vaccination, Cunningham-Erves et al. (2023) found there was trust in the science of vaccines even when there was medical mistrust and mistrust of the government. This phenomenon may have been at work in my research which included a highly educated, possibly more affluent cohort who may also have had fewer barriers to access.

Another potential explanation for the eventual vaccination of most participants in my study is the impact of successful public health efforts to decrease the racial disparities in vaccine uptake with outreach to marginalized populations. Mortiboy et al. (2023) reported that in Durham County, North Carolina on April 1, 2021, only 32.0% of Black or African American residents had received 1 dose of COVID-19 vaccine and 14.0% had received 2 doses, compared to 54.8% and 23.4% respectively for non-Hispanic Whites in the county. In May 2021, the Durhan County Department of Public Health began extensive outreach

efforts and vaccine events targeting Black, indigenous, and other people of color and by December 2021, 46.9% of Black or African American residents were fully vaccinated, up 32.9 percentage points, suggesting public efforts may contribute to observed vaccine uptake rates among African Americans.

Interpretation in the Context of the Theoretical Frameworks

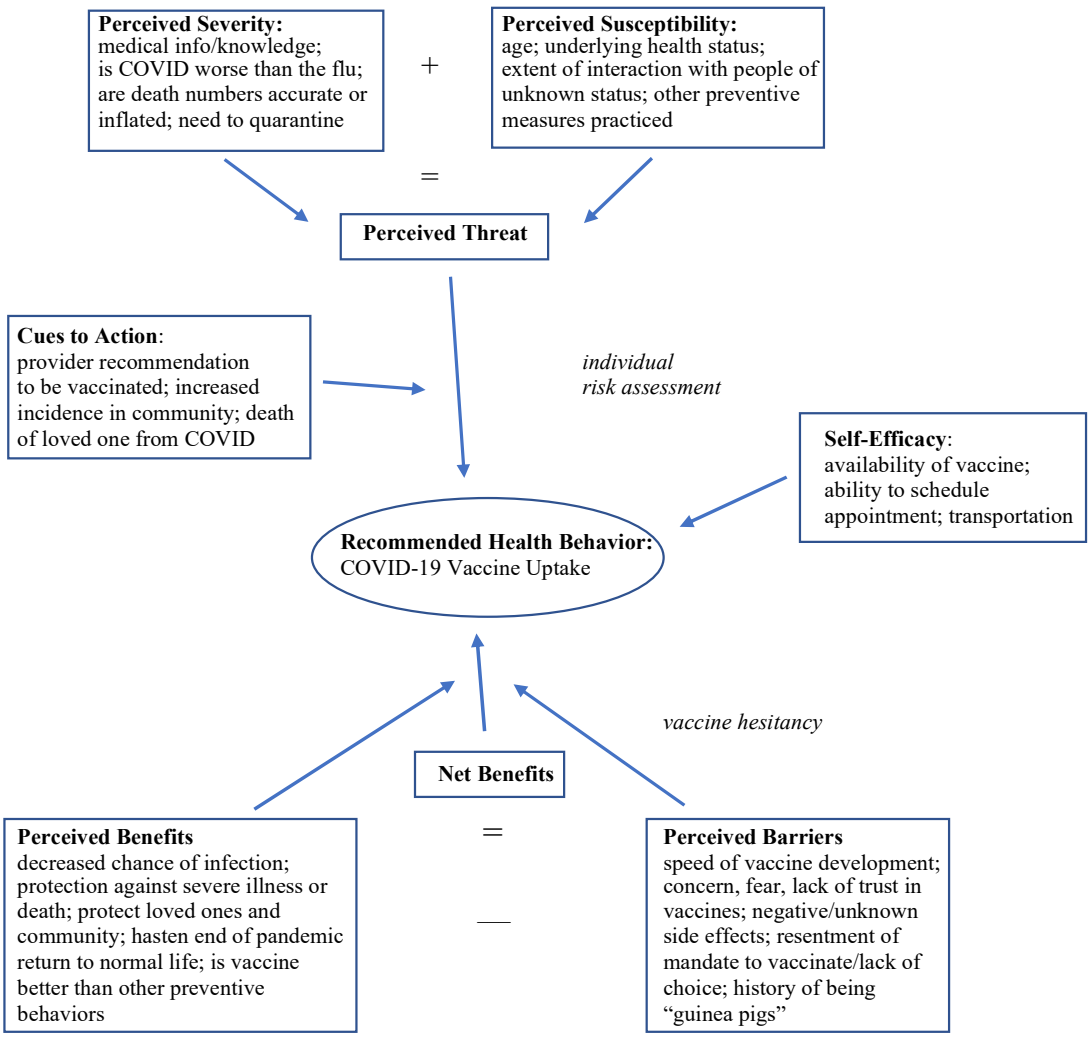
The theoretical foundations for this study were the health belief model (HBM) and the theory of planned behavior (TPB). These theories were chosen because vaccination is a health behavior that has been explained by both theories and they each provide an insightful framework for interpretation of the study results.

Health Belief Model

The constructs of the HBM are perceived severity, perceived susceptibility, perceived benefit, perceived barriers, and cues to action (Rosenstock, 1974). Figure 1 depicts the application of the HBM to COVID-19 vaccination and provides context for the findings. As described in Chapter 2, perceived severity speaks to an individual's belief about the seriousness of the illness and is based not only on their understanding or knowledge of the medical impact on them physically, but also on their perception of the impact the disease could have on them socially. Perceived susceptibility refers to an individual's perception of their personal risk of contracting the disease and the HBM posits the more vulnerable an individual believes they are, the more likely they will be to adopt the recommended behavior (Rosenstock, 1974). In the case of COVID-19, this could include the emotional and financial toll of needing to quarantine if you contract the disease.

Figure 1

Application of the HBM to COVID-19 Vaccination



In this study, the predictor variables race-related stress and medical mistrust are hypothesized to be barriers to vaccination while COVID-19 worry would function as a cue to action in this model, expressed as concern, fear, or anxiety about the COVID-19 virus or disease related to the individual, their family, friends, or community (Funk & Tyson 2021; King et al. 2021). In their interviews with Black adult study participants from the

Congregational Health and Education Network, a faith based non-profit organization housed at Nashville General Hospital in Tennessee, Cunningham-Erves et al. (2023) found that decisional balance, weighing the pros and cons of vaccination, was the most commonly mention process by which the decision to be vaccinated or not was made.

Asare et al. (2020) applied the constructs of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy in their examination of the impact of COVID-19 and adherence to public health recommendations to practice social distancing, wear a mask, and frequently wash hands. After adjusting for covariates, analysis showed increased perceived severity and perceived benefits were significantly ($p < 0.01$) and positively associated with adherence to recommendations. The high vaccination rate found in this research could be an extension of the findings of Asare et al. (2020) because their study did not include vaccination intention among the dependent variables.

The current findings could also be seen as an extension of the research conducted by Nong et al. (2021) before the development of the COVID-19 vaccines. In the quantitative arm of their study, those investigators unexpectedly found that African Americans showed *higher* trust in public health information sources and *higher* willingness to participate in public health efforts than Whites. In interviews conducted with 26 survey respondents (19 African American, 2 White, 5 other/unknown) to further understand these results, three broad themes emerged as motivations for willingness to participate in public health efforts: altruism (concern for family and community members), risk acknowledgement (awareness of the high mortality among African Americans), and confidence that the public health efforts would help mitigate the spread of COVID-19. Interviews by Cunningham-Erves et

al. (2023) also identified preventing the spread of disease to family, friends, and community as a perceived benefit of vaccination. In other data collected prior to the availability of the vaccine, in a representative sample of 738 U.S. adults, Heleg-Larsen et al. (2022) found worry about COVID-19 was a better predictor of willingness to be vaccinated than cognitive risk (likelihood of being personally infected or dying from COVID-19).

In this study, the COVID-19 worry variable was measured using the FCV-19S instrument and the data were extremely skewed towards the higher values (-1.054) with a mean score = 3.87, mode = 4.00, range of 1.43 to 5.00, as measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Perz et al. (2022) used the same instrument to measure COVID-19 worry in a sample of 237 U.S. undergraduate and graduate students aged 18-60 years (17% African American) from a small public university and found a mean score of 2.59. The substantially higher, extremely skewed scores in my study indicate this cohort of highly educated African Americans was also characterized by a higher than normal amount of concern about COVID-19 which may have factored into the HBM constructs of perceived risk and cues to action to become a driver for the high vaccination rate in my study.

There is other research in support of the notion that worry, fear or anxiety about the seriousness of the disease, personal susceptibility, and risk to family and community members influences COVID-19 vaccine intentions. w et al. (2021) found the average concern about COVID-19 infection was approximately 87% and 84.7% of their cohort expressed a medium to high perception of overall COVID-19 risk. Chu and Liu (2021) found that overall, fear was a significant positive predictor of vaccination intent (β [SE] =

0.050 [0.018], $p < 0.01$) as were the perceived community benefits of vaccination (β [SE] = 0.228 [0.089], $p < 0.01$). In addition, their representative sample of 934 participants agreed COVID-19 was a severe health risk. Gerretsen et al. (2021) similarly found perceived seriousness of disease was a positive predictor of vaccination intention; conversely, King et al. (2021) found a lack of worry about COVID-19 was a predictor of vaccine hesitancy. The findings in my study of an extremely high rate of vaccination could also be a more nuanced extension of this previous work and reflect a heightened perception of disease threat and concern for their community among the highly educated African Americans in this sample.

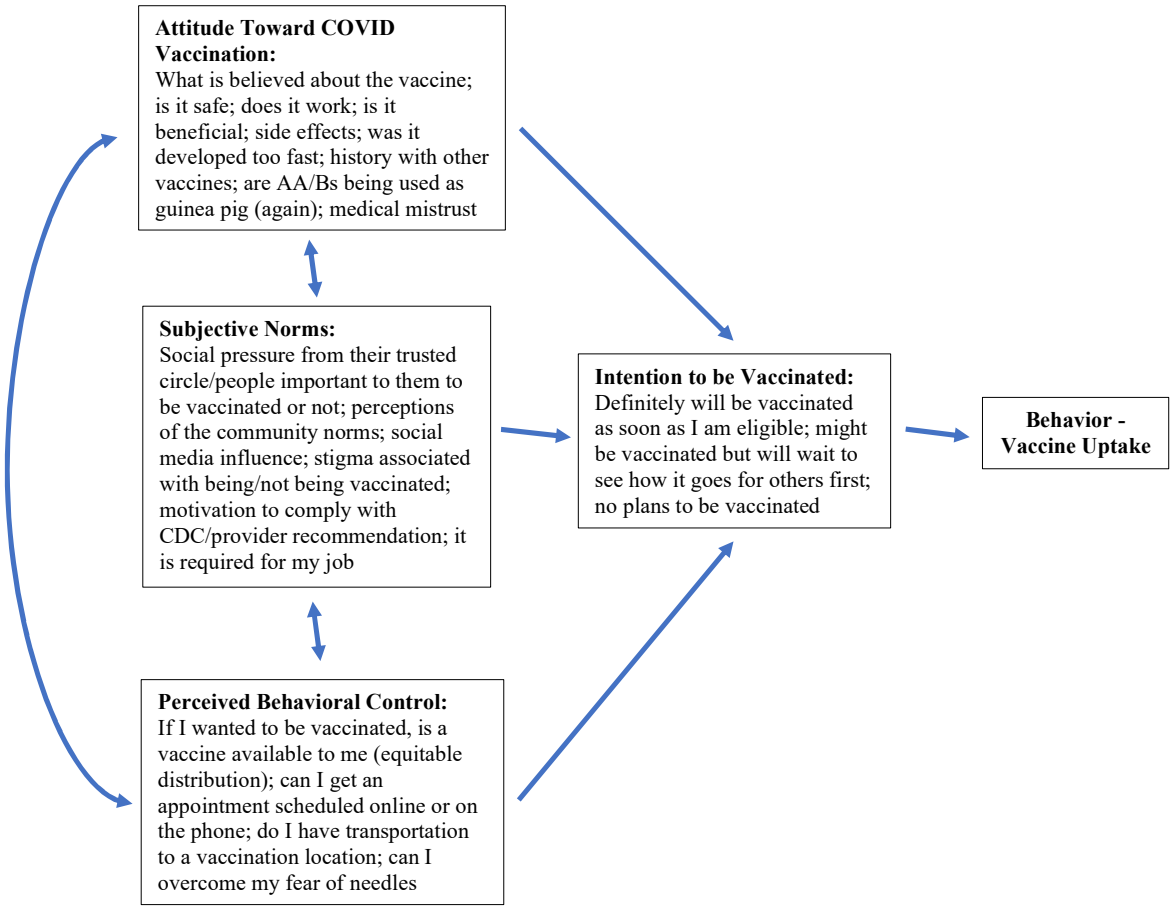
Theory of Planned Behavior

In this study sample, 101 out of 188 respondents (53.7%) reported no intentional delay in getting vaccinated against COVID-19. Of the 87 respondents who reported an intentional delay, 83 (95.4%) ended up accepting the vaccine at some point. These data can also be understood through the lens of the TPB. The constructs of the TPB are attitudes, subjective norms, and perceived behavioral control and the theory posits these constructs influence intention which is the ultimate determinate of behavior (Ajzen, 1991), and Figure 2 depicts the application of the TPB to COVID-19 vaccination.

Trust in the effectiveness and safety of the vaccine was identified by participants in the Cunningham-Erves et al. (2023) study as a factor in their decision to get vaccinated. At some point, there was a change in attitude toward COVID-19 vaccination among my study participants that affected intention and ultimately behavior among the majority of those who endorsed vaccine hesitancy. This explanation is corroborated by qualitative data collected by Huang et al. (2023) in February-June 2021from a majority Black sample of 29 adults in the

Figure 2

Application of the TPB to COVID-19 Vaccination



Southern United States Those authors identified changing vaccine beliefs as a common theme across all participants, which was exemplified by comments such as "*I think everyone (in my work community) questioned how fast it was made, how safe it would be. But I now see that people are changing their minds and they actually are taking that extra step to go ahead and get vaccinated.* #12, Black female, age 55" (p. 4) and "*I have to read, and I have*

to study and get more information before I just go and be like 'Okay, I want a COVID-19 vaccine'. #8, Black female, age 33" (p.4) which both exemplify the TPB construct of subjective norms. Cunninghan-Erves et al. (2023) found that the experiences of family and community members, social norms, was a motivation for getting vaccinated.

The results from Huang et al. (2023) also point to the TPB construct of subjective norms as an explanation for the findings in my study. The theme of positive vaccine promotion from trusted members within the community was reflected in the quote from participant #25, Black female, age 60 who stated, "*When I saw that the numbers were coming down, and I started hearing a lot of positive reports from other people that had gotten it, and my doctor started giving me some positive reports*" (p. 7). These findings also concur with earlier research that found many African Americans had a "wait-and-see" attitude towards the COVID-19 vaccines (Dong et al., 2022; Ignacio et al., 2022; King et al., 2021; Recht & Weber, 2021). A key finding in qualitative research conducted by Martinez Leal et al. (2023) in August 2021 to September 2022 to explore COVID-19 vaccine attitudes among minoritized adults in Houston was that participants' reluctant attitude towards vaccination could be changed once they became confident in the benefits of vaccination and subjective norms were identified as factors that could facilitate that change.

It has been suggested that medical mistrust may be a part of the subjective norm in the African American community (Laurencin et al., 2021). This study may add credence to that claim in that my sample had a mean medical mistrust score of 3.22 which was higher than the mean African American medical mistrust score of 2.35 reported by Thompson et al. (2021) in their study of the association between race/ethnicity and COVID-19 trial

participation and vaccine uptake. They found that medical mistrust partially mediated the relationship between African American race and COVID-19 vaccine uptake.

A recent CDC analysis of data collected from almost 1.2 million respondents (10.7% non-Hispanic African American) to the National Immunization Survey–Adult COVID Module from April 2021 to November 2022, showed that experiences of racism in a healthcare setting was associated with significantly higher (p<0.05) prevalence of non-vaccination among African Americans, even after adjusting for a number of factors including age, gender, education and income (Elam-Evans et al., 2023). The vaccination rate of my sample appears to be at odds with these findings; however, this survey used a single question, “When seeking health care in the last 2 years, do you feel your experiences were worse than, the same as, or better than (those of) persons of other races or ethnicities?” to assess experience of discrimination, and 10.7% of the 123.5 thousand African Americans in the sample endorsed “worse” experiences, interpreted as discrimination. My findings could possibly be explained by the more rigorous assessment of discrimination, the relatively small sample size, or because it is the experience of racism itself and not the stress it causes that is predictive of low vaccine uptake. No published studies could be found that examine the relationship between race-related stress specifically and COVID-19 health behavior.

Using the 5C model of vaccination behavior that includes confidence, complacency, constraints, calculation, and collective responsibility, Thier et al. (2023) examined the psychological antecedents of COVID-19 vaccine acceptance in a national sample of 1,497 Black Americans in February-March 2021. They found that COVID-19 vaccination attitude was a significant predictor of COVID-19 vaccination intention ($b = 0.45$, $p < 0.001$).

Confidence (defined as "*trust in a vaccine's safety and efficacy, as well trust in their delivery system and policymaker's motivations*", p. 65), calculation (defined as "*individuals' engagement in extensive information searching*", p. 65), and collective responsibility (defined as "*willingness to protect others by contributing to herd immunity through one's own vaccination*", p. 65) were each significant predictors of attitude ($b = 0.94$, $p < 0.001$; $b = -0.28$, $p = 0.009$; $b = 0.80$, $p = 0.002$ respectively). Confidence and collective responsibility also significantly predicted intention ($b = 0.28$, $p < 0.001$; $b = 0.57$, $p = 0.001$ respectively). In addition, confidence, calculation, and collective responsibility indirectly predicted intention through attitude ($b = 0.42$, CI 95% [0.30, 0.56], $p < 0.001$; $b = -0.12$, CI 95% [-0.24, -0.03], $p = 0.02$; $b = 0.36$, CI 95% [0.07, 0.64], $p = 0.01$ respectively). Thier et al. (2023) also found heterogeneity in attitude towards COVID-19 vaccination by age and gender in their all African American sample.

The Role of Education

The role of education in COVID-19 vaccination behavior has been interspersed throughout each of the previous sections, but a more focused discussion follows. Although 46.3% of this sample endorsed vaccine hesitancy, nearly 100% were vaccinated. Peña et al. (2023) found that overall education was significantly positively associated ($p <0.001$) with being vaccinated. When discussing my research in light of existing literature, it is important to underscore that this sample was much more highly educated than the general target population; 97.9% of the sample possessed a bachelor's degree as compared to only 22.6% of the general African American adult population (Postsecondary National Policy Institute, 2023). Consequently, these findings shed light on a subset only of the target population and

may be reflective of the literature that shows African Americans are not a monolith when it comes vaccine hesitancy and uptake.

There is not a robust or conclusive body of knowledge about the impact of education and income among African Americans on COVID-19 worry (Berhe et al., 2022), race-related stress (Neblett et al., 2016), or medical mistrust (Benkert et al., 2019b). However, a recent study by Andersen et al. (2023) did show that overall, the more education an individual had, the more likely they were to be vaccinated against COVID-19. In their analysis of secondary longitudinal data collected from December 2020 to July 2021 in a national survey of a representative sample of 6,087 U.S. adults, Na et al. (2023) found that in unadjusted models, African Americans exhibited slower vaccine acceptance than White Americans, however, higher education, income, and perceived risk were all mediators of African American vaccine uptake. All three of these factors were characteristics of my study sample.

Because nearly 100% of this sample was vaccinated, there was not sufficient variation in the dichotomous COVID-19 vaccine uptake outcome variable to test the correlation with any of the predictor variables race-related stress, medical mistrust, and COVID-19 worry. However, Cunningham-Erves et al. (2023) were able to compare the characteristics of vaccinated and unvaccinated African Americans and found a lack of understanding about the vaccine's development, efficacy, and safety was a factor in the decision making of unvaccinated individuals. Such a lack of understanding is less likely to be found among the highly educated.

In addition, Andersen et al. (2023) showed the odds of COVID-19 vaccination

increased with increasing education. In their online survey of 1,674 U.S. adults in which racial and ethnic minorities were oversampled, researchers found that overall, compared to those with a HS education or less, respondents with some college had an OR = 1.07 and those with post-secondary degrees had significantly higher odds of being vaccinated; participants with an associate degree had OR = 1.31 (95% CI [1.00, 1.71], $p = 0.049$) and those with a bachelor's or graduate degree had OR = 1.41 (95% CI [1.12, 1.78], $p = 0.003$). The results of my research, in which over 95% of respondents had a bachelor's degree or higher education and over 95% of whom were vaccinated, are aligned with these recent findings, and may suggest that the relationship between higher education and COVID-19 vaccine uptake may be even stronger among African Americans.

S. C. Quinn et al. (2018) examined African American within group differences in vaccine-related measures and racial factors and found significant subgroup variation by age, education, and income in flu vaccine confidence and hesitancy. Freimuth et al. (2017) found heterogeneity by age and income in flu vaccine behavior among African Americans and their data suggested the subgroups to target to encourage vaccine uptake were younger, lower income African Americans. Although S. C. Quinn et al. (2018) examined African American vaccine hesitancy and not uptake, they found significant subgroup differences in behavior by education. Increased levels of education were significantly associated with decreased general vaccine hesitancy ($p = 0.021$) and with decreased flu vaccine hesitancy ($p = 0.006$).

In the context of the current literature, the findings of the current study suggest similar African American subgroup variation may exist in COVID-19 vaccination behavior.

In a more recently study, K. G. Quinn et al. (2023) did examine COVID-19 vaccination in a sample of 538 Chicagoans who self-identified as Black, mixed-race Black, or African American. Using structural equation modeling to examine the relationship between racism, community violence, and vaccine uptake, the authors correctly predicted that those who had experienced more racism and community violence would have higher medical mistrust, which they measured using the GBMMS. In their study, K. G. Quinn et al. (2023) found the mean medical mistrust score to be 2.69 (on a scale of 1-5, low to high); in my study, the mean medical mistrust score was 3.22. Despite a relatively high amount of medical mistrust, and a degree of hesitancy consistent with other research, the highly educated African American sample in this research did ultimately accept the COVID-19 vaccine. This finding suggests that education may be a moderator of the relationship between medical mistrust and COVID-19 vaccine uptake. Interestingly, Na et al. (2023) found that higher education, along with higher income and greater perceived risk, was also a mediator of African American vaccine uptake.

Limitations of the Study

In designing this study, based on the literature, I expected the MTurk derived research sample would be approximately representative of the general African American adult population, allowing the findings of this study to be moderately generalizable. However, the MTurk sample recruited was not representative. This sample was notably distinct from the general target population in that 97.9% of the sample population had a college education or higher and 97.9% of this cohort reported having received at least 1 dose of the COVID-19 vaccine. The study sample may also have been more affluent. Moslimani

et al. (2023) report that in 2021 the median *household* income for single race non-Hispanic African Americans was $45,300 whereas 66.5% of the *individuals* in this study had an annual income of $35,000-$69,999 and 29.3% reported an income of $70,000 or more. Consequently, generalizations to the wider population should be limited and made cautiously.

Because this research relied on self-reported behaviors, it was vulnerable to social desirability which was mitigated by making the survey anonymous. This study was also vulnerable recall bias, which was perhaps the most significant threat. The survey was self-administered in July 2023 but asked participants to report their attitudes and behaviors at the time COVID-19 vaccines first became available in late 2020 and early 2021. In general, recall bias can strengthen or weaken observed associations in research (Spencer et al., 2017), and even though there were no statistically significant correlations in the study, recall bias may have decreased the accuracy of the participants' responses. Because the outcome variables COVID-19 vaccine hesitancy and COVID-19 vaccine uptake were dichotomous they likely were not affected by this bias. However, the reported scores for the predictor variables race-related stress, medical mistrust, and COVID-19 worry may have been increased or decreased due to this bias.

Though the sample recruited met the minimum required size for statistical power, it was still relatively small and due to financial and time constraints as a student I was not able to oversample African Americans who were not vaccinated to allow me to test the research questions involving the outcome variable COVID-19 vaccine uptake. In addition, race-related stress and medical mistrust may be ubiquitous in the African American population,

making it difficult to get a sample of the target population that has no or low levels of these characteristics. Finally, there are other individual factors that could influence COVID-19 vaccine hesitancy and uptake that were not accounted for in this study, such as pre-existing health conditions, prior vaccine history, fear of needles, or political affiliation.

Recommendations

Based on the findings in this study, a direct test of education as protective against experiences of racism and medical mistrust in African American COVID-19 vaccination behavior is warranted as a follow-up. Purposefully sampling higher and lower educated samples of vaccinated and unvaccinated African Americans is recommended when looking for relationships between variables. Additional research to test the impact of educational interventions on vaccine hesitancy and uptake among African Americans would also add to the knowledge base.

Future research in this area should also address some of the limitations identified above by oversampling for unvaccinated individuals and recruiting a larger, random probability sample. Additional quantitative research comparing various race-related factors in decision making among vaccinated and unvaccinated African Americans is warranted and should include enough participants from different socioeconomic strata to examine the within group differences that may exist to discover which traits and attributes might be protective against harmful health behaviors. Qualitative studies are also recommended to further our understanding of the facilitators and barriers to COVID-19 vaccination among African Americans, including a more in depth exploration of how vaccinated African Americans are able to overcome experiences of racism and medical mistrust to adopt

recommended behaviors.

The relationship between racial discrimination, medical mistrust, education, and health behavior decision making among African Americans needs to be studied further and the results of this and other research suggest these determinants should be studied not only as predictor variables, but also as moderators and mediators. Because there is evidence that racial disparities in receipt of an initial dose of COVID-19 vaccine have closed while disparities in booster uptake persist, future studies should measure vaccination status by the number of COVID-19 vaccines received as opposed to receipt of at least 1 shot. In addition, there may be value in examining the length of intentional delay instead of measuring it as a dichotomous variable.

Finally, the predictor variables in this study primarily represented elements of perceived threat, perceived barriers, and cues to action but did not capture the perceived benefits of vaccination which my sample may have considered to be very high given their rate of vaccination. Future studies should account for this missing HBM construct more explicitly and should focus on other motivations for vaccination represented in the TBP construct of subjective norms such as concern for family and community members and desire to get the same protections being given to other racial groups.

Implications

Based on the review of the literature, the finding of no significant correlation between race-related stress, medical mistrust, or COVID-19 worry and the outcome variable COVID-19 vaccine hesitancy was unexpected as was the finding that almost all of the participants were vaccinated against COVID-19. One implication of this research is

highlighted in a recent qualitative study by Huang et al. (2023) that found that one of the facilitators of vaccine uptake among African Americans was seeing prominent affluent people get vaccinated. As one study participant, a 43 year old Black male put it "*But my thing is look at who's getting it (the COVID-19 vaccine). The president is getting it, the vice president, people with influence and money and power are getting it*." (p. 7). This suggests that one way to overcome the justified medical mistrust endorsed by so many African American may be for the U.S. public health machinery to show itself trustworthy by being among the first adopters of a recommended behavior, and to do so in a way that is very visible to marginalized populations who experience health disparities, to garner their trust.

It may be that race-related stress is not an important predictor of COVID-19 vaccination behavior in African Americans, perhaps because racism, either interpersonal, social, or structural, is so ubiquitous in the African American lived experience that the stress it produces does not have an impact on health behavior, or because as a perceived barrier to vaccination it must be weighed in relation to the perceived benefits. And though there was no significant association found between medical mistrust and vaccine hesitancy, the mean level of mistrust in the highly vaccinated sample was higher than the mean medical mistrust found in studies that did find a significant association between those variables. That may suggest that education is protective against the negative impact of medical mistrust on health behavior among African Americans.

The results of this study may highlight subtle nuances about African American heterogeneity that are just beginning to be uncovered in the literature. Data from this study suggest higher education may enable African Americans to successfully navigate the lack of

information, excess information, misinformation, and disinformation that comprise the so called COVID-19 infodemic (Badr et al., 2021; Berhe et al., 2022; Cunningham-Erves et al., 2023; Majee et al., 2023; Martinez Leal et al., 2023; Minaya et al., 2022; Zarocostas, 2020). These findings may also suggest that higher educated and higher income African Americans are more likely to initiate vaccine uptake than has previously been described in the literature for African Americans as a racial subgroup, despite equally high or higher levels of race-related stress and medical mistrust that have been documented among African Americans of lower educational attainment. There is a need to first dissect the monolith of African Americans, or revise the approach given that African Americans are not a monolith, to be able to design effective public health interventions for the race as a whole.

Positive Social Change

Vaccines are only effective if the public gets inoculated and understanding the factors that facilitate and inhibit vaccine uptake is critical to the success of any vaccination program. In the African American community, experiences of racism and medical mistrust are permeating but not insurmountable challenges for public health officials. Results from this study suggest the impact of experiences of racism and medical mistrust might be overcome by educational interventions among African Americans. My findings also indicate public health programs should target not just race specific populations but differentiated subgroups within race-specific populations as different subgroups will have different needs for resources, information, and communication strategies. Culturally tailored interventions should not only respect this within group diversity but should also acknowledge and take into account the effect of historical and contemporary racism, leverage communication via

trusted messengers, and appeal to altruism by emphasizing collective community responsibility.

As new variants of COVID-19 continue to evolve, and as other public health crises are likely to emerge, effectively promoting vaccination and other healthy behaviors among marginalized populations will help mitigate the health inequities that may be created by these public health challenges. Considering that the CDC and many state and local agencies have declared racism a social determinant of health, understanding how experiences of racism negatively impact health and how those effects can be overcome will be crucial to achieving positive health outcomes among those for whom racism is a part of their lived experience.

Conclusion

Despite continued findings in recent literature that COVID-19 vaccination rates among African Americans remains suboptimal (Cunningham-Erves et al., 2023; Foy et al., 2023; Lloyd et al., 2023) the vaccination rate in the current study was 97.9%. However, the sample recruited for this analysis was not representative of the target population of non-Hispanic African American adults. The sample population was substantially more highly educated, likely had a higher income, and their rate of vaccination was overwhelmingly higher than non-Hispanic African Americans in general.

African American adults with a college education or better can be hesitant yet vaccinated. Although this study did not find any significant correlations between race-related stress, medical mistrust, COVID-19 worry, and COVID-19 vaccination behavior among African Americans it did find that African American adults who have a college

education or better did accept the COVID-19 vaccine, despite higher levels of race-related stress and medical mistrust than endorsed by other samples of African Americans. This study highlights the need to further explore the different characteristics, attitudes, and predictors of health behavior among the various subgroups of African Americans. Such investigations will serve to inform tailored interventions to help reduce the health disparities experienced broadly by this racial group as it relates to vaccine hesitancy and uptake, both for the present pandemic and for future public health crises.

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Appendix A: Survey Instrument

PRE-SCREEN Questions

1. Have you completed this survey before?
    a. ____Yes
    b. ____No
2. Date of birth _____Month _____ Day _____ Year
3. What is your race?
    a. ____White alone
    b. ____Black or African American alone
    c. ____American Indian and Alaska Native alone
    d. ____Asian alone
    e. ____Native Hawaiian and Other Pacific Islander alone
    f. ____Two or More Races
4. Are you Hispanic or Latino?
    a. ____Yes
    b. ____No

SECTION A – RACE-RELATED STRESS

Instructions

The questions in this section are intended to sample some of the experiences that Black people have in this country because of their "blackness." There are many experiences that a Black person can have in this country because of his/her race. Some events happen just once, some more often, while others may happen frequently. Below you will find listed

some of these experiences, for which you are to indicate those that have happened to you or someone very close to you (i.e., a family member or loved one). It is important to note that a person can be affected by those events that happen to people close to them; this is why you are asked to consider such events as applying to your experiences when you complete this section. Please check the number on the scale (0 to 4) that indicates the reaction you had to the event at the time it happened. Do not leave any items blank. If an event has happened more than once, refer to the first time it happened.

1. You notice that crimes committed by White people tend to be romanticized, whereas the same crime committed by a Black person is portrayed as savagery, and the Black person who committed it, as an animal.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

    4 ___ This event happened, and I was extremely upset

2. Salespeople/clerks did not say thank you or show other forms of courtesy and respect (e.g., put your things in a bag) when you were shopping at some White/non-Black owned businesses.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

3. You notice that when Black people are killed by the police, the media informs the public of the victim's criminal record or negative information in their background, suggesting they got what they deserved.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

    4 ___ This event happened, and I was extremely upset

4. You have been threatened with physical violence by an individual or group of White/non-Blacks.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

    4 ___ This event happened, and I was extremely upset

5. You have observed that White kids that commit violent crimes are portrayed as "boys being boys," while Black kids who commit similar crimes are wild animals.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

6. You seldom hear or read anything positive about Black people on the radio, TV, in newspapers, or history books.

   0 ___ This never happened to me

   1 ___ This event happened but did not bother me

   2 ___ This event happened, and I was slightly upset

   3 ___ This event happened, and I was upset

   4 ___ This event happened, and I was extremely upset

7. While shopping at a store the salesclerk assumed that you couldn't afford certain items (e.g., you were directed towards the items on sale).

   0 ___ This never happened to me

   1 ___ This event happened but did not bother me

   2 ___ This event happened, and I was slightly upset

   3 ___ This event happened, and I was upset

   4 ___ This event happened, and I was extremely upset

8. You were the victim of a crime, and the police treated you as if you should just accept it as part of being Black.

   0 ___ This never happened to me

   1 ___ This event happened but did not bother me

   2 ___ This event happened, and I was slightly upset

   3 ___ This event happened, and I was upset

   4 ___ This event happened, and I was extremely upset

9. You were treated with less respect and courtesy than Whites and other non-Blacks while in a store, restaurant, or other business establishment.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

    4 ___ This event happened, and I was extremely upset

10. You were passed over for an important project although you were more qualified and competent than the White/non-Black person given the task.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

    4 ___ This event happened, and I was extremely upset

11. Whites/non-Blacks have stared at you as if you didn't belong in the same place with them, whether it was a restaurant, theater, or other place of business.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

    4 ___ This event happened, and I was extremely upset

12. You have observed the police treat Whites/non-Blacks with more respect and dignity

than they do Blacks.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

13. You have been subjected to racist jokes by Whites/non-Blacks in positions of authority and you did not protest for fear they might have held it against you.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

14. While shopping at a store, or when attempting to make a purchase, you were ignored as if you were not a serious customer or didn't have any money.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

15. You have observed situations where other Blacks were treated harshly or unfairly by Whites/non-Blacks due to their race.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

16. You have heard reports of White people/non-Blacks who have committed crimes, and in an effort to cover up their deeds falsely reported that a Black man was responsible for the crime.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

    4 ___ This event happened, and I was extremely upset

17. You notice that the media plays up those stories that cast Blacks in negative ways (child abusers, rapists, muggers, etc.) usually accompanied by a large picture of a Black person looking angry or disturbed.

    0 ___ This never happened to me

    1 ___ This event happened but did not bother me

    2 ___ This event happened, and I was slightly upset

    3 ___ This event happened, and I was upset

    4 ___ This event happened, and I was extremely upset

18. You have heard racists remarks or comments about Black people spoken with impunity

by White public officials or other influential White people.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

19. You have been given more work or the most undesirable jobs at your place of employment while the White/non-Black of equal or less seniority and credentials is given less work, and more desirable tasks.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

20. You have heard or seen other Black people express a desire to be White or to have White physical characteristics because they disliked being Black or thought it was ugly.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

21. White people or other non-Blacks have treated you as if you were unintelligent and

needed things explained to you slowly or numerous times.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

22. You were refused an apartment or other housing; you suspect it was because you're Black.

0 ___ This never happened to me

1 ___ This event happened but did not bother me

2 ___ This event happened, and I was slightly upset

3 ___ This event happened, and I was upset

4 ___ This event happened, and I was extremely upset

SECTION B – MEDICAL MISTRUST

Instructions

Below is a list of statements dealing with your general feelings about the healthcare system. Read each item carefully and indicate whether you strongly agree, agree, feel neutral, disagree, or strongly disagree with each statement.

23. Doctors and healthcare workers sometimes hide information from patients who belong to your racial group.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

24. Doctors have the best interests of people of your racial group in mind.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

25. People of your racial group should not confide in doctors and healthcare workers because it will be used against them.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

26. People of your racial group should be suspicious of information from doctors and healthcare workers.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

27. People of your racial group cannot trust doctors and healthcare workers.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

28. People of your racial group should be suspicious of modern medicine.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

29. Doctors and healthcare workers treat people of your racial group like “guinea pigs”.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

30. People of your racial group receive the same medical care from doctors and healthcare workers as people from other groups.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

31. Doctors and healthcare workers do not take the medical complaints of people of your racial group seriously.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

32. People of your racial group are treated the same as people of other groups by doctors and healthcare workers.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

33. In most hospitals, people of different racial groups receive the same kind of care.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

34. You have personally been treated poorly or unfairly by doctors or healthcare workers because of your race.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

SECTION C – COVID-19 Worry

Instructions

COVID-19 vaccines first became available to high priority groups in November 2020 and to the general public in April 2021. Please indicate how much you agreed with the following statements **at the time COVID-19 vaccines first became available**. Do not leave any questions blank; answer all questions to the best of your recollection.

35. ***When COVID-19 vaccines first became available*** I was very afraid of COVID-19.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

36. ***When COVID-19 vaccines first became available*** it made me uncomfortable to think

about COVID-19.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

37. ***When COVID-19 vaccines first became available*** my hands became clammy when I thought about COVID-19.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

38. ***When COVID-19 vaccines first became available*** I was afraid of dying because of COVID-19.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

39. ***When COVID-19 vaccines first became available*** when watching news and stories about COVID-19 on social media, I became nervous or anxious.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

40. ***When COVID-19 vaccines first became available*** I could not sleep because I was worrying about getting COVID-19.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

41. ***When COVID-19 vaccines first became available*** my heart raced or palpitated when I thought about getting COVID-19.

1 ___ Strongly disagree

2 ___ Disagree

3 ___ Neither agree nor disagree

4 ___ Agree

5 ___ Strongly agree

SECTION D – COVID-19 Vaccination Status

42. Have you had at least one dose of a COVID-19 vaccination?

0 ___ No

1 ___ Yes

SECTION E – COVID-19 Vaccination Hesitancy

Instructions

For the next question, ***intentional delay*** means you ***purposely did not get your first shot as soon as you were eligible and able because you did not want the vaccine or did not want the vaccine yet***. It has nothing to do with whether or not you *could have* gotten the vaccine before you did. It has to do with *whether or not you wanted to get the vaccine as soon as you became eligible*.

43. *Did you **intentionally delay** getting your first COVID-19 vaccination?*

0 ___ No

1 ___ Yes

SECTION F – Demographic Questions (for statistical purposes only)

44. Gender

0 ___ Non-binary

1 ___ Male

2 ___ Female

45. What state do you live in? _____

46. Highest Education

1 ___ Less than HS diploma

2 ___ HS diploma/GED

3 ___ Some college/Associate degree

4 ___ Bachelor' degree

5 ___ Some post graduate school

6 ___ Graduate degree

47. Annual income

1 ___ < $35,000

2 ___ $35,000-$69,999

3 ___ ≥$70,000

Appendix B: Permission to Use IRRS-B

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Order Date	20-Jan-2023	**Type of Use**	Republish in a thesis/dissertation
Order License ID	1314174-1		
ISSN	1947-6302	**Publisher**	SAGE Publications, Inc.
		Portion	Chapter/article

LICENSED CONTENT

Publication Title	Measurement and evaluation in counseling and development	**Publication Type**	e-Journal
		Start Page	149
Article Title	Development and Validation of a Short Form of the Index of Race-Related Stress (IRSS)-Brief Version	**End Page**	167
		Issue	3
		Volume	32
		URL	http://www.umi.com/pqdauto/
Author/Editor	Association for Measurement and Evaluation in Counseling and Development (U.S.), Association for Assessment in Counseling and Education (U.S.), Association for Assessment and Research in Counseling,		
Date	01/01/1984		
Language	English		
Country	United States of America		
Rightsholder	American Counseling Association		

REQUEST DETAILS

Portion Type	Chapter/article	**Rights Requested**	Main product
Page Range(s)	165-167	**Distribution**	Worldwide
Total Number of Pages	3	**Translation**	Original language of publication
Format (select all that apply)	Print, Electronic	**Copies for the Disabled?**	No
Who Will Republish the Content?	Author of requested content	**Minor Editing Privileges?**	No
		Incidental Promotional Use?	No
Duration of Use	Life of current edition		
Lifetime Unit Quantity	Up to 499	**Currency**	USD

NEW WORK DETAILS

Title	Association Between Race-Based Stress, Medical Mistrust, and COVID-19 Vaccination Behavior Among African Americans	**Institution Name**	Walden University
		Expected Presentation Date	2023-03-20
Instructor Name	JaMuir Robinson		

ADDITIONAL DETAILS

Order Reference Number	N/A	**The Requesting Person/Organization to Appear on the License**	Lisa A. Cash

REUSE CONTENT DETAILS

Title, Description or Numeric Reference of the Portion(s)	Appendix: The Index of Race-Related Stress-Brief Version	**Title of the Article/Chapter the Portion Is From**	Development and Validation of a Short Form of the Index of Race-Related Stress (IRSS)-Brief Version
Editor of Portion(s)	Utsey, S. O.	**Author of Portion(s)**	Utsey, S. O.
Volume of Serial or Monograph	32	**Issue, if Republishing an Article From a Serial**	3
Page or Page Range of Portion	149-167	**Publication Date of Portion**	1999-01-01

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Appendix C: Permission to Use GBMMS

CCC Marketplace

Special Requests> Special Request Details

Health Education & Behavior

Article: Correlates of Medical Mistrust Among Minority Women at Risk for HIV and Their Networks

GENERAL INFORMATION

Request ID	Request Date
600109515	24 Jan 2023
Request Status	**Deny Reason**
Denied	Other (Gratis permission to distribute up to 250 co.)

ALL DETAILS

COMMENTS

Add Comment / Attachment

Show Previous Comments (4)

31 Jan 2023 6:03:15 PM, byPublisher Representative

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View Less

26 Jan 2023 6:01:50 PM, by Lisa Cash

I will be using the questionnaire as one section of my survey instrument to collect data for my doctoral research project. My survey instrument (and thus this questionnaire) will be published in m View More

26 Jan 2023 2:04:29 PM, by Publisher Representative

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Appendix D: Permission to Use FCV-19S

From: [redacted]
Sent: Tuesday, February 21, 2023 4:44 PM
To: Lisa Cash
Subject: Re: Use of Adapted FCV-19S Instrument in Dissertation Research

Dear Lisa,

Thank you for your interest in the scale my colleague and I adapted for use in a U.S. college population. I am happy to share it with you and have included the questions and Likert scale below my signature. The scale is scored on a 1-5 Likert scale with no reverse items and a simple sum as the total score.

Please let me know if you have any questions. I would be very interested in hearing about your research as it progresses—please let me know how your dissertation goes. Good luck!

Best,

Catherine

Catherine A. Perz, Ph.D.
Professor of Psychology
Director, Counseling Psychology M.A. Program
Director, Forensic Psychology M.A. Program
University of Houston-Victoria

Please answer the next seven questions using this scale:
Strongly disagree
Disagree
Neither agree nor disagree
Agree
Strongly agree

1. I am most afraid of coronavirus-19.
2. It makes me uncomfortable to think about coronavirus-19.
3. My hands become clammy when I think about coronavirus-19.
4. I am afraid of dying because of coronavirus-19.
5. When watching news and stories about coronavirus-19 on social media, I become nervous or anxious.
6. I cannot sleep because I'm worrying about getting coronavirus-19.
7. My heart races or palpitates when I think about getting coronavirus-19.

From: Lisa Cash <lisa.cash@waldenu.edu>
Sent: Tuesday, February 21, 2023 3:33 PM
To: Perz, Catherine A. [redacted]
Cc: JaMuir M. Robinson [redacted]
Subject: Use of Adapted FCV-19S Instrument in Dissertation Research
[external email]

Hello Dr. Perz,

I hope this email finds you well.

I am a candidate for a PhD in Public Health at Walden University, and I am planning a study to examine the association between race-related stress, medical mistrust, COVID-19 fear and anxiety, and COVID-19 vaccination behavior among African Americans.

In my review of the literature, I found your paper "Validation of the Fear of COVID-19 Scale in a US College Sample." To my knowledge, this is the only study to validate the FCV-19S in a US population and I appreciate the changes you made to several of the words in the original English translation of the instrument to avoid confusion.

I'm writing to ask for permission to use your version of the FCV-19S in my doctoral research. If you are amenable, would you kindly send me a copy of your survey as administered, including the answer key which was not included in your paper. If you agree to my use of your version of the FCV-19S, I will of course give you all the appropriate credits in my dissertation and in any other publications or presentations that might result from my work.

I can be reached by email or by phone at the number below if you have any questions about my study or request. I have also cc'd my chair, Dr. Robinson, should you wish to speak with her about my research.

Thanks in advance for your consideration.

Best wishes,

Lisa Cash
Walden University
PhD(c) Public Health

Appendix E: Analysis Parameters

Research Questions and Hypotheses	Independent variables	Dependent variables	Control variables	Statistical test
RQ1: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States? $H_0$1 = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States. $H_1$1 = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.	race-related stress (ordinal)	COVID-19 vaccine hesitancy (dichotomous)		Bivariate logistic regression
RQ2: Is there a relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States? $H_0$2 = There is no relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States. $H_1$2 = There is a significant relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.	Medical mistrust (ordinal)	COVID-19 vaccine hesitancy (dichotomous)		Bivariate logistic regression
RQ3: Is there a relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States? $H_0$3 = There is no relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States. $H_1$3 = There is a significant relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.	COVID-19 worry (ordinal)	COVID-19 vaccine hesitancy (dichotomous)		Bivariate logistic regression
RQ4: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States? $H_0$4$_1$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States.	race-related stress (ordinal) medical mistrust (ordinal) COVID-19 worry (ordinal)	COVID-19 vaccine hesitancy (dichotomous)		multivariate logistic regression adjusted OR and 95% CI

$H_1 4_1$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States. $H_0 4_2$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States when controlling for age, gender, education, and income. $H_0 4_2$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine hesitancy, measured by endorsement of intentional delay, among self-identified non-Hispanic African American adults in the United States when controlling for age, gender, education, and income.	race-related stress (ordinal) medical mistrust (ordinal) COVID-19 worry (ordinal)	COVID-19 vaccine hesitancy (dichotomous)	age (continuous) gender (dichotomous) education (ordinal) income (ordinal)	
RQ5: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States? $H_0 5$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States. $H_1 5$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.	race-related stress (ordinal)	COVID-19 vaccine uptake (dichotomous		Bivariate logistic regression
RQ6: Is there a relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States? $H_0 6$ = There is no relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States. $H_1 6$ = There is a significant relationship between medical mistrust, measured by the Group Based Medical Mistrust Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.	medical mistrust (ordinal)	COVID-19 vaccine uptake (dichotomous)		bivariate logistic regression
RQ7: Is there a relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States? $H_0 7$ = There is no relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States. $H_1 7$ = There is a significant relationship between COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19	COVID-19 worry (ordinal)	COVID-19 vaccine uptake (dichotomous		bivariate logistic regression

vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.				
RQ8: Is there a relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States? $H_0 8_1$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States. $H_1 8_1$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States.	race-related stress (ordinal) medical mistrust (ordinal) COVID-19 worry (ordinal)	COVID-19 vaccine uptake (dichotomous)		multivariate logistic regression adjusted OR and 95% CI
$H_0 8_2$ = There is no relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States when controlling for age, gender, education, and income. $H_1 8_2$ = There is a significant relationship between race-related stress, measured by the Index of Race-Related Stress Brief version, medical mistrust, measured by the Group Based Medical Mistrust Scale, COVID-19 worry, measured by the Fear of COVID-19 Scale, and COVID-19 vaccine uptake, measured by receipt of at least one shot, among self-identified non-Hispanic African American adults in the United States when controlling for age, gender, education, and income.	race-related stress (ordinal) medical mistrust (ordinal) COVID-19 worry (ordinal)	COVID-19 vaccine uptake (dichotomous)	age (continuous) gender (dichotomous) education (ordinal) income (ordinal)	