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SARS-CoV-2 Vaccination Hesitancy and Behaviors in a National Sample of People Living with HIV

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Abstract

As COVID-19 vaccinations became available in early 2021, we collected data from a US national sample of 496 people living with HIV (PLWH) to assess COVID-19 vaccination uptake and attitudes. The study was cross-sectional, and data were collected using an online survey between March and May 2021. At the time, 64% of the participants received at least one dose of a COVID-19 vaccine. Vaccine uptake was associated with older age and more years living with HIV, higher educational attainment, less vaccine hesitancy, and higher perceived COVID-19 vulnerability. Rates of vaccination uptake were highest among sexual and gender minority (SGM) cisgender men and transgender participants as well as those more likely to report undetectable viral load. Among the 166 unvaccinated, intention to receive the vaccine was related to older age and years living with HIV as well as lower vaccine hesitancy. Among the unvaccinated, SGM individuals demonstrated higher intent than non-SGM individuals. Findings indicate relatively high levels of vaccination in PLWH, although uptake and intent are not monolithic in the population. Patterns of vaccination are consistent with the health behavior literature in so much as those with higher levels of perceived heath vulnerability due to age as well as higher levels of proactivity about their HIV health are more likely to be vaccinated or intend to be vaccinated. Ongoing vigilance is required to vaccinate the US population, particularly those with underlying conditions such as HIV, as is the need to tailor health messaging to the highly diverse population of PLWH, with particular emphasis on the intersection of HIV and SGM status.

Keywords: COVID-19, vaccine, vaccination beliefs, HIV/AIDS, health behavior

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Introduction

INEQUITABLE DEADLY PANDEMICS, such as HIV and COVID-19, have magnified the deep-seated disparities evident in American society.[1,2] For the past four decades, the HIV epidemic has disproportionality affected marginalized populations, namely sexual and gender minority (SGM) men as well as Black and Hispanic/Latinx populations.[3,4] These epidemiological patterns are largely analogous in the COVID-19 pandemic where people of color are placed at higher risk for SARS-CoV-2 infection, hospitalization, and death.[5] Specifically, 34% of all COVID-19 deaths in April 2020 were Black/African American, although they only comprise 13% of the US population.[6,7] Recent studies have also documented that SGM men and lesbian, gay, bisexual, transgender, questioning/queer, and other SGM (LGBTQ+) people of color are placed at higher risk for SARS-CoV-2 infection than other subpopulations.[8,9] These vast disparities affecting marginalized communities resulting from systemic inequities within the United States are notably highlighted in worldwide outbreaks.[10–12]

At the onset of the COVID-19 pandemic, researchers and officials at the US Centers for Disease Control and Prevention (CDC) were concerned that people living with HIV (PLWH) might have an increased risk for severe illness if they contracted SARS-CoV-2 due to the high prevalence of comorbidities.[13] A study in New York City found that while PLWH were not overrepresented in COVID-19 cases compared with the general population, they had more adverse health outcomes due to COVID-19.[14] Although historically PLWH may have more exposure to public health messaging, the experiences of PLWH are not monolithic.

As COVID-19 has disproportionately affected structurally marginalized communities, in particular Black and Brown people and LGBTQ+ populations,[3,9,15] it is imperative to understand whether there are differences among these groups regarding overall COVID-19 vulnerability and vaccination uptake and intent among PLWH. While increasing access to the COVID-19 vaccine is critical to inoculation efforts, there is widespread vaccine hesitancy among adults in the United States,[16] particularly among Black, and Hispanic/Latinx individuals.[16,17]

Presently, there is limited information on COVID-19 vaccination attitudes and hesitation among PLWH in the United States.[17–19] Results from a French study found that 28.7% of participants found that hesitancy to be vaccinated for COVID-19, and those who reported history of antibodies, were significantly less likely to have received the vaccine.[18] In a study of PLWH in Miami, Black non-Latinx PLWH, compared with non-Black Latinx participants, were less likely to believe that vaccine information is reliable and trustworthy and that vaccines are effective in preventing COVID-19 disease.[19] Given the amount of misinformation and disinformation that has been spread around the COVID-19 vaccine[20–22] and the potential adverse impact of COVID-19 on PLWH, it is important to understand the overall picture of COVID-19 vaccination uptake and intent among this population.

As COVID-19 vaccinations became available in the United States in early 2021, we collected data from a diverse national sample of PLWH to (1) describe rates of COVID-19 vaccination intent and uptake and (2) determine demographic, COVID-19-, and HIV-related factors associated with COVID-19 vaccine intent and uptake.

Methods

Study design

The study was cross-sectional in design, and data were collected using an online survey between March and May 2021. The purpose of this study was to understand COVID-19 vaccination uptake of PLWH in the United States. The inclusion criteria for this study required that participants (1) be 18 years old or older, (2) have received an HIV diagnosis before enrolling in the study, and (3) live in the United States or the US territories. The Rutgers University Institutional Review Board approved the study protocol (2021000063).

Procedures

Recruitment materials were distributed via three different channels: (1) professional and other community listservs (e.g., American Public Health Association, ACT UP, Gay and Lesbian Medical Association), (2) institutional social media accounts (e.g., Facebook, LinkedIn, Twitter), and (3) HIV service organization listservs (e.g., Ryan White Part A Grantees List and AIDS Education Training Center). The survey was distributed using Qualtrics and available in English only. Interested individuals first completed an online screening questionnaire to determine their eligibility. If eligible, participants provided online consent before completing the survey. At the end of the survey, participants were given the option to enter into a raffle to win one of two $60 gift cards. The survey was self-administered and took $\sim$10 min to complete. The sample for this study comprised 496 participants who met the inclusion criteria.

Measures

Participant demographic information included in the analyses was self-reported.

Age. Participants were asked to report their age in years. Participants 90 years old or older were recorded as 90.

Race and ethnicity. All participants were asked about their racial and ethnic identity. Participants could select from the following groups: Asian, Black or African American, Hispanic or Latinx, Native American or Alaska Native, Pacific Islander, White, or different identity with the option to specify. For analytic purposes, the responses were then collapsed into the following four categories: Black/African American non-Hispanic, Latinx/Hispanic, White non-Hispanic, and Other non-Hispanic racial and ethnic groups.

Education. Participants indicated highest level of education completed, which, for analytic purposes, were recoded into the following three categories: high school or GED or less, some college or associate degree, and bachelor's degree or more.

Employment. Employment status was as full-time employment, part-time employment, or unemployment.

Nation of birth. Participants were asked if they were born in the United States (yes/no).

Gender and sexual identity. Participants were asked to report their gender identity using the following categories: cisgender male, cisgender female, non-binary/genderqueer/

gender non-conforming, transgender man, transgender woman, or different identity with the option to specify. For sexual identity, participants were asked to choose from the following categories: asexual, gay or lesbian, queer, heterosexual or straight, bisexual, or different identity with the option to specify. For analytic purposes, the sexual orientation and gender identity variables were collapsed into a single variable: sexual minority cisgender man, nonsexual minority cisgender man, sexual minority cisgender woman, nonsexual minority cisgender woman, and transgenders of all sexual orientations.

COVID-19 vaccine intent

Participants were asked about their intent to receive any of the COVID-19 vaccines using a single question (''How likely are you to take the COVID-19 vaccination when it becomes available to you?'') using a 5-point Likert scale. Very likely and likely were collapsed into one category and unlikely and very unlikely were collapsed into another. Unsure responses remained as recorded.

COVID-19 vaccine uptake

Participants were asked if they had received at least one dose of the COVID-19 vaccine and were able to select either yes, no, or unsure. For the purposes of these analyses, respondents who selected unsure were coded as missing. We note that participants who received the Janssen vaccine only required one dose. In our sample, this was only nine of those vaccinated.

Perceived COVID-19 vulnerability

Participants were asked about their perceived vulnerability to COVID-19 via two items: ''Has a friend or family member been diagnosed with COVID-19?'' and ''Has a friend or family member died due to COVID-19?'' Responses were collected dichotomously (yes/no).

Vaccine hesitancy

All participants were asked to complete the Vaccine Hesitancy Scale (Shapiro et al.).[23]

HIV health indicators

Number of years since HIV diagnosis. All participants were asked to report the year that they received their HIV diagnosis.

Opportunistic infection diagnosis. Participants were provided a list of opportunistic infections classified as AIDS defining[24] and asked to identify ones they had experienced.

CD4 count. Participants were asked to report on their last CD4 count from the options: less than 200, 201 to 500, more than 500, and unknown.

HIV viral load. Participants were asked to report on their last viral load (polymerase chain reaction) from the options: undetectable, less than 500 but not undetectable, 500 to 5000, more than 5000, and unknown.

Analytic plan

We undertook descriptive analyses of participant demographic characteristics as well as COVID-19 vaccine uptake and COVID-19 vaccine intent. We then conducted bivariable analyses of the demographic characteristics by COVID-19 vaccine uptake and COVID-19 vaccine intent. Based on the bivariable analyses, we conducted binary logistic regression analyses for COVID-19 vaccine uptake as well as ordinal logistic regression analyses for COVID-19 vaccine intent. Participants who responded unsure for vaccine uptake were excluded from the analyses. All analyses were conducted using SPSS 26 (IBM). Participant ZIP codes were matched to state data using the postal (zip) code R 0.3.1 package in R 4.1.0 and mapped using QGIS version 3.14.15 (Open Source Geospatial Foundation).

Results

Survey participants ($n=496$) were average age of 50.08 years [standard deviation (SD) = 0.61; range, 19–78 years] at the time of the survey and were diverse in terms of race and ethnicity and other demographic factors (Table 1 and Fig. 1). Gay cisgender men made up the largest proportion of participants ($n=226$, 45.6%), followed by heterosexual cisgender women ($n=101$, 20.4%).

COVID-19 vaccine uptake and intent

Of the 496 participants, 310 (62.5%) reported that a friend or family member was diagnosed with COVID-19 and 158 (31.9%) participants had a friend or family member who died due to COVID-19. A large proportion of participants received at least one dose of a COVID-19 vaccine ($n=319$, 64.3%). Of these, 149 (46.7%) participants received the Pfizer/BioNTech, 144 (45.1%) participants received the Moderna, 13 (4.1%) participants received AstraZeneca, 9 (2.8%) participants received the Johnson & Johnson, and 4 (1.3%) were unsure. Of those who had not received a COVID-19 vaccine at the time of the survey, 110 (66.3%) stated that they intended to receive the vaccine when it becomes available to them.

Vaccine uptake was associated with age, education, sexual orientation and gender identity, vaccine hesitancy, COVID-19 vulnerability, number of years since HIV diagnosis, and viral load (Table 2). Participants who had received at least one dose of any of the COVID-19 vaccines were older on average than those who had not received a dose. Participants who received at least one dose of a vaccine had less vaccine hesitancy and had been living with HIV for a longer period of time than those who had not received a dose. Participants who had a family member or friend who was diagnosed with or who died due to COVID-19 also were more likely to have received at least one dose of the COVID-19 vaccine. Finally, participants who reported an undetectable viral load indicated higher rates of vaccine uptake (68.6% vs. 55.6%; $\chi^2=5.52$; $df=1$; $p=0.02$). Lower vaccination rates were noted among SGM versus non-SGM individuals ($p<0.001$).

We then examined those factors to explain COVID-19 vaccine uptake intent (defined as yes, no, and may be) among those who had yet to receive a dose of vaccination ($n=166$; Table 2). Those who intended to receive the COVID-19

Table 1. Sociodemographic Characteristics of Participants in a Nationwide Survey of COVID-19 Vaccine Hesitancy Among People Living with HIV ($n=496$), United States, 2021

	Full sample (n = 496)	
	n	%
Age, mean (SD)	50.08 (0.61)	
Race and ethnicity		
Asian/Pacific Islander non-Hispanic	12	2.4
Black/African American non-Hispanic	131	26.4
Latinx/Hispanic	73	14.7
Native American/Alaska Native non-Hispanic	26	5.2
White non-Hispanic	237	47.8
Multi-racial non-Hispanic	16	3.2
Missing	1	0.2
Educational attainment		
High school/GED/trade school or less	106	21.4
Some college/associate degree	156	31.5
Bachelor's degree or more	234	47.2
Employment status		
Unemployed	219	44.2
Employment—full time	188	37.9
Employment—part time	89	17.9
Nation of birth		
United States	448	90.3
Outside United States	48	9.7
US region of residence		
Northeast	176	35.5
Midwest	43	8.7
South	141	28.4
Mountain	21	4.2
Pacific	110	22.2
Sexual orientation and gender identity		
Heterosexual cisgender men	43	8.7
Gay cisgender men	226	45.6
Bisexual cisgender men	21	4.2
Other sexual orientation cisgender men	16	3.2
Heterosexual cisgender women	101	20.4
Lesbian cisgender women	10	2.0
Bisexual cisgender women	16	3.2
Other sexual orientation cisgender women	3	0.6
Heterosexual transgender men	2	0.4
Gay transgender men	6	1.2
Bisexual transgender men	2	0.4
Lesbian transgender women	4	0.8
Bisexual transgender women	3	0.6
Other sexual orientation transgender women	3	0.6
Heterosexual non-binary/other	10	2.0
Gay/lesbian non-binary/other	15	3.0
Bi non-binary/other	3	0.6
Other sexual orientation non-binary/other	10	2.0
Missing	2	0.4
COVID-19 vaccine		
COVID-19 vaccine hesitancy score, mean (SD)	2.00 (0.04)	
Received at least one dose of a COVID-19 vaccine		
Yes	319	64.3
No	166	33.5
Unsure	10	2.0
Missing	1	0.2
Vaccine intent ($n=166$)		
No	19	11.4
May be	37	22.3
Yes	110	66.3
COVID vulnerability		
Friend or family member been diagnosed with COVID-19		
Yes	310	62.5
No	185	37.3
Missing	1	0.2
Friend or family member died due to COVID-19		
Yes	158	31.9
No	338	68.1
HIV health indicators		
Number of years since HIV diagnosis, mean (SD)	19.74 (11.30)	
Diagnosed with OI		
No	223	45.0
Yes	248	50.0
Don't know	22	4.4
Missing	3	0.6
CD4 count		
Under 500	213	42.9
500+	253	51.0
Don't know	27	5.4
Missing	3	0.6
Viral load		
Detectable	96	19.4
Undetectable	386	77.8
Don't know	13	2.6
Missing	1	0.2

OI, opportunistic infection; SD, standard deviation.

vaccine were older than others in the sample. We found that participants who did not intend to receive a COVID-19 vaccine reported higher levels of vaccine hesitancy [mean (M) = 2.99, SD = 0.69] compared with the uncertain ($M=2.46$, SD = 0.46) and intended ($M=1.93$, SD = 0.65) groups. Also, those who intended to receive the COVID-19 vaccine had a higher average number of years since their diagnosis of HIV than the may be and no groups. Finally, variability was noted across sexual and gender identity groups with more than 70% of both SGM men and transgender participants, regardless of sexual identity, indicating vaccine uptake, with lower rates reported by non-SGM participants and SGM women ($p<0.001$). Among the unvaccinated, similar patterns are reported for intent ($p<0.01$).

Multi-variable modeling in the form of binary logistic regression analyses was utilized to explain vaccine uptake (Table 3) and ordinal logistic regression models to examine vaccine intent (Table 4). The model for vaccine uptake was

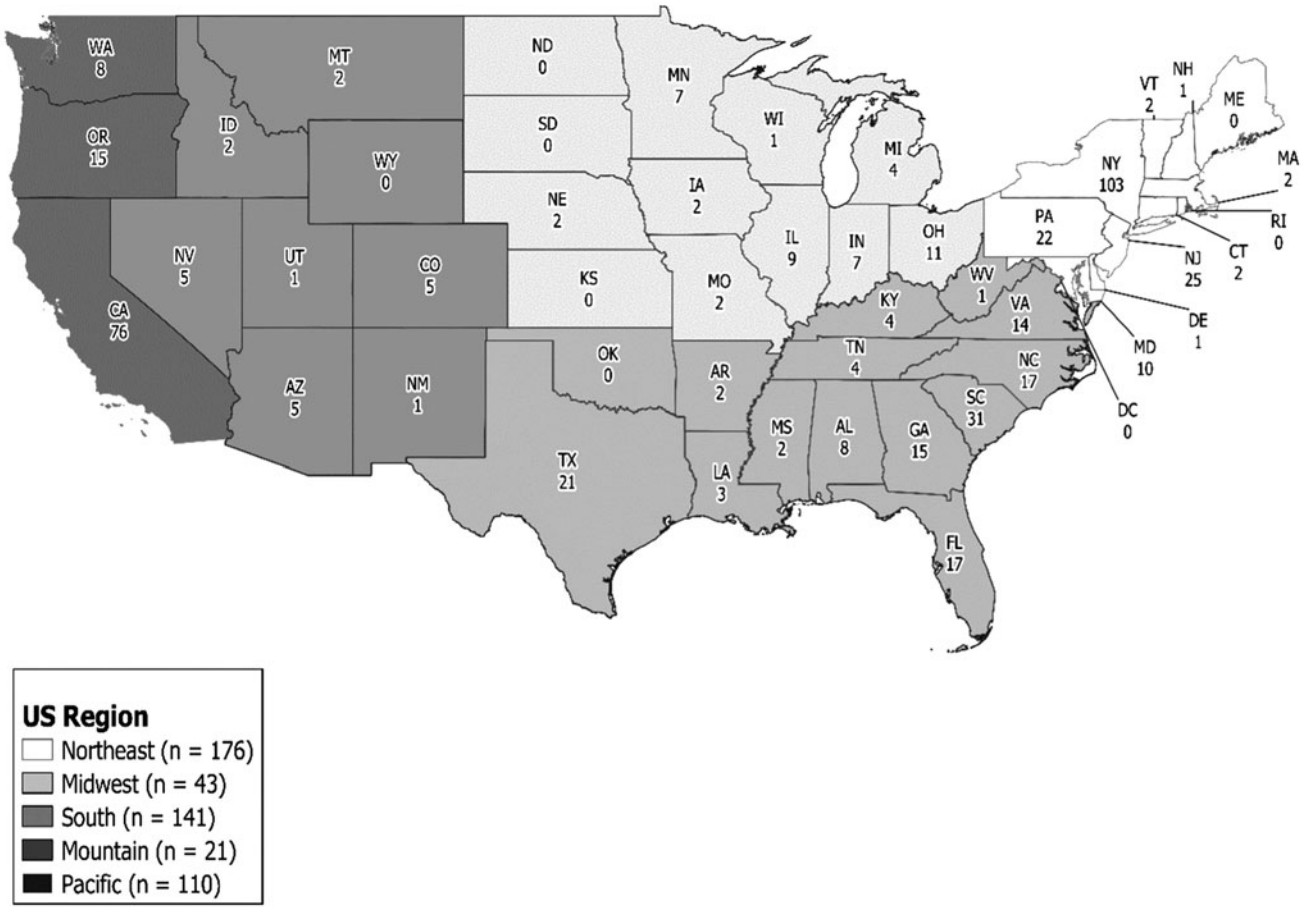

FIG. 1. Number of participants, by region and state, in a nationwide survey of COVID-19 vaccine hesitancy among PLWH ($n=496$), United States, 2020. Pacific region includes three participants who resided in noncontiguous states and territories: Alaska ($n=2$), Hawaii ($n=1$).

significant ($\chi^2=49.03$; $df=15$; $p\leq0.001$; classification fit = 67.5%). When controlling for all other factors, participants who held a bachelor's degree or more education had 1.79 [95% confidence interval (CI) 1.02–3.14, $p<0.05$] times higher odds of receiving at least one dose of a COVID-19 vaccine compared with participants with a high school degree, GED, trade school degree, or less education.

Furthermore, the adjusted ordinal logistic regression model for vaccine intent was significant ($\chi^2=61.78$; $df=7$; $p<0.001$) and assumption of parallel lines was not violated ($\chi^2=7.28$; $df=7$; $p=0.400$). Specifically, higher levels of COVID-19 vaccine hesitancy were significantly associated with lower vaccine uptake intent. A one unit increase in vaccine hesitancy score was associated with a 0.18 (95% CI 0.10–0.32) lower odds of either not planning or being uncertain about receiving the vaccine holding all other factors constant.

Discussion

This study contributes to the extremely limited knowledge available on the impacts of COVID-19 in the lives of PLWH, specifically as it relates vaccine intent and uptake in this population. The majority of this sample (64%) reported receiving at least one dose of a vaccine, which was significantly higher than the national average at the time of data collection (March–May 2021).[25] Despite this relative success, patterns were not monolithic with results demonstrating vaccine hesitancy and low uptake among some subgroups. In particular, this study found that participants who had been living with HIV a longer period of time were more likely to have received at least one dose of the vaccine, as were those that reported an undetectable viral load. These findings align closely with a recent study of Black Americans living with HIV.[17]

We also note that Black participants in this sample constitute the group least likely to be vaccinated. These findings should be considered in light of studies that have demonstrated the relation between race and residential segregation for individuals infected with HIV[26,27] and COVID-19[28] in the United States, with people of color tending to live in less economically advantaged neighborhood. These patterns, in turn, affect outcomes, where higher rates of mortality due to HIV[29,30] and COVID-19 infections[31,32] are linked to poverty. In effect, these patterns replicate in COVID-19.

Moreover, such racial disparities are observed in HIV vaccine and treatment trials.[33] Taken together, these findings suggest that successfully managing COVID-19 and HIV is predicated largely on continued access to trusted health care providers and trusted sources of health information, which likely affects decision-making around vaccine uptake as well as treatments for both HIV and COVID-19. Importantly, access to care is lower for people of color living in poverty.[34]

Table 2. COVID-19 Vaccine Intent and At Least One Vaccine Dose Received Among People Living with HIV in a Nationwide Survey, by Sociodemographic Characteristics, United States, 2021

	Received at least one dose of a COVID-19 vaccine[a] (n = *485*)					*Vaccine uptake intent* (n = *166*)						
	No (n = *166*)		*Yes* (n = *319*)			*No* (n = *19*)		*May be* (n = *37*)		*Yes* (n = *110*)		
	n	%	n	%	p	n	%	n	%	n	%	p
Age, mean (SD)	47.02 (12.56)		52.18 (13.53)		**<0.001**	42.79 (12.37)		43.05 (11.61)		49.15 (12.53)		**0.010**
Race and ethnicity					0.062							0.464
Black/African American non-Hispanic	54	41.9	75	58.1		6	11.1	16	29.6	32	59.3	
Latinx/Hispanic	26	36.6	45	63.4		3	11.1	4	14.8	20	74.1	
Other non-Hispanic	19	37.3	32	62.7		4	21.1	2	10.5	13	68.4	
White non-Hispanic	66	28.3	167	71.7		6	9.2	15	23.1	44	67.7	
Education attainment					**<0.001**							0.247
Some college/associate degree	54	36.0	96	64.0		7	12.7	17	30.9	31	56.4	
Bachelor's degree or more	62	26.6	171	73.4		5	8.2	10	16.4	46	75.4	
High school/GED/trade school or less	50	49.0	52	51.0		7	14.0	10	20.0	33	66.0	
Employment status					0.69							0.468
Unemployed	76	35.2	140	64.8		11	14.3	15	19.5	51	66.2	
Employed	90	33.5	179	66.5		8	9.0	22	24.7	59	66.3	
Nation of birth					0.978							0.205
United States	150	34.2	288	65.8		18	11.9	36	23.8	97	64.2	
Outside United States	16	34.0	31	66.0		1	6.7	1	6.7	13	86.7	
US region					0.131							0.694
Northeast	52	30.1	121	69.9		4	7.7	10	19.2	38	73.1	
Midwest	10	25.6	29	74.4		1	10.0	2	20.0	7	70.0	
South	59	42.4	80	57.6		10	16.9	15	25.4	34	57.6	
Mountain	8	38.1	13	61.9		0	0.0	3	37.5	5	62.5	
Pacific	35	32.4	73	67.6		4	11.4	7	20.0	24	68.6	
Sexual orientation and gender identity (*n* = 483)					**<0.001**							**0.005**
Sexual minority cisgender men	67	25.9	192	74.1		4	6.0	6	9.0	57	85.1	
Nonsexual minority cisgender women	43	43.0	57	57.0		7	16.3	11	25.6	25	58.1	
Sexual minority cisgender women	18	64.3	10	35.7		3	16.7	8	44.4	7	38.9	
Transgender participants—all sexual orientations	16	29.1	39	70.9		1	6.3	4	25.0	11	68.8	
Nonsexual minority cisgender men	20	48.8	21	51.2		4	20.0	6	30.0	10	50.0	
COVID vaccine												
COVID-19 vaccine hesitancy score, mean (SD)	2.16 (0.72)		1.90 (0.81)		**<0.001**	2.99 (0.69)		2.46 (0.46)		1.93 (0.65)		**<0.001**
COVID vulnerability												
Friend/family diagnosed with COVID-19 (*n* = 484)					**0.048**							0.451
Yes	95	31.0	211	69.0		10	10.6	18	19.1	66	70.2	
No	71	39.9	107	60.1		9	12.5	19	26.4	44	61.1	
Friend or family member died due to COVID-19					**0.011**							0.375
Yes	41	26.3	115	73.7		4	10.0	6	15.0	30	75.0	
No	125	38.0	204	62.0		15	11.9	31	24.6	80	63.5	

(*continued*)

Table 2. (Continued)

	Received at least one dose of a COVID-19 vaccine[a] (n=485)					Vaccine uptake intent (n=166)						
	No (n=*166*)		*Yes* (n=*319*)			*No* (n=*19*)		*May be* (n=*37*)		*Yes* (n=*110*)		
	n	%	n	%	p	n	%	n	%	n	%	p
HIV health indicators												
Number of years since HIV diagnosis (*n*=479), mean (SD)	18.07 (11.1)		20.97 (11.14)		**0.007**	16.47 (11.49)		14.16 (11.16)		19.67 (10.76)		**0.026**
Diagnosed with OI					0.133							0.206
No	79	35.6	143	64.4		12	15.4	13	16.7	53	67.9	
Yes	75	30.9	168	69.1		6	7.9	19	25.0	51	67.1	
Don't know	9	52.9	8	47.1		1	11.1	4	44.4	4	44.4	
CD4 count					0.589							0.396
Under 500	74	35.7	133	64.3		10	13.5	19	25.7	45	60.8	
500+	83	33.3	166	66.7		8	9.6	16	19.3	59	71.1	
Viral load (*n*=472)					**0.019**							0.133
Detectable	40	44.4	50	55.6		4	10.0	13	32.5	23	57.5	
Undetectable	120	31.4	262	68.6		15	12.5	21	17.5	84	70.0	

[a]The total sample for receiving at least one dose of a COVID-19 vaccine was 485 because missing (*n*=1) and unsure (*n*=10) were treated as missing. SD, standard deviation.

Indeed, the COVID-19 pandemic has set back the federal and state ''Ending the Epidemic'' plans by disrupting the HIV prevention and care continuum, particularly for those at the margins of society.[35,36] Increasing and maintaining access to HIV-related care and services for underserved populations are urgently needed as the pandemic continues to surge, as engagement in care may engender trust in COVID-19 health information and recommendations and thus serve as an effective avenue for encouraging COVID-19 vaccination uptake.

Recent studies on the broader US population have observed lower COVID-19 vaccine acceptance among younger adults.[37,38] This finding also emerged among our sample of PLWH. Older individuals likely feel placed at higher risk for severe COVID-19 complications, suggesting that public health messaging around the importance of vaccination must evolve to reach younger populations, many of whom have largely expressed significantly less concern about contracting COVID-19.[39] Promoting preventative health measures among young groups can be difficult as other research has shown low rates of preventive health care utilization and the need for health promotion among this demographic.[40]

Engaging young PLWH in consistent medical care and promoting the benefits of U=U [i.e., antiviral therapy (ART)] adherence leading to an undetectable viral load) and other preventative health measures, such as the COVID-19 vaccine, are of paramount importance. However, we also note that that our study finding may be linked to date of data collection, when the vaccine was largely available to the older population. Still, as time has progressed, younger adults continue to be less likely to receive COVID-19 vaccination than their older peers, 65 years and older.[41]

In our study and across other studies of US-based populations, lower educational attainment was also associated with lower vaccine intent and acceptance.[37,38] Although educational attainment can be a useful proxy for ascertaining potential access to and acceptance of trustworthy sources of health information, it is important to address the extent to which misinformation and disinformation have powerfully shaped the response to the pandemic, including at the federal, state, and societal levels.[22,42] In a recent study of COVID-19-related trust, health information sources, and social relationship/health service disruption among PLWH in Georgia (United States), the authors found high rates of inaccurate information about COVID-19 among participants, as well as low levels of trust in CDC and government sources of health information.[43]

Similarly, in a study of COVID-19 mistrust among Black PLWH, nearly all participants endorsed some type of COVID-19 mistrust idea, and more than half endorsed mistrust beliefs related to the COVID-19 vaccine and treatment, as well as greater COVID-19-related mistrust was associated with increased vaccine and treatment hesitancy, suggesting an urgent need to address misinformation.[17] Although our study suggests that many subgroups of PLWH have been vaccinated or intend to obtain the vaccine, our findings also call for tailored efforts to address misinformation about PLWH.

Drawing upon strategies employed in the HIV epidemic, the Popular Opinion Leader (POL) approach may be an effective method of engendering trust and confidence in public health COVID-19 messaging.[44] In Wisconsin, researchers

Table 3. Binary Logistic Regression Models Examining COVID-19 Vaccine Access Among Participants in a Nationwide Survey of People Living with HIV, United States, 2021

	Received at least one dose of a COVID-19 vaccine[a] (n = *485)*					
	OR	*95% CI*	p	*aOR*	*95% CI*	p
Age	1.03	1.01–1.04	**<0.001**	1.02	1.00–1.05	0.059
Race and ethnicity			0.064			0.768
Black/African American non-Hispanic	0.55	0.35–0.86	**0.009**	0.75	0.45–1.27	0.292
Latinx/Hispanic	0.68	0.39–1.20	0.184	0.87	0.47–1.61	0.651
Other non-Hispanic	0.67	0.35–1.26	0.209	0.92	0.43–1.95	0.828
White non-Hispanic	Ref			Ref		
Education attainment			**<0.001**			0.126
Some college/associate degree	1.71	1.02–2.85	**0.040**	1.37	0.77–2.42	0.281
Bachelor's degree or more	2.65	1.63–4.31	**<0.001**	1.79	1.02–3.14	**0.044**
High school/GED/trade school or less	Ref			Ref		
Sexual orientation and gender identity (*n* = 483)			**<0.001**			**0.039**
Sexual minority cisgender men	2.73	1.39–5.35	**0.003**	1.69	0.80–3.60	0.171
Nonsexual minority cisgender women	1.26	0.61–2.62	0.531	1.06	0.47–2.36	0.890
Sexual minority cisgender women	0.53	0.20–1.42	0.206	0.50	0.17–1.47	0.211
Transgender participants—all sexual orientations	2.32	1.00–5.40	0.051	1.77	0.71–4.39	0.218
Nonsexual minority cisgender men	Ref			Ref		
COVID vaccine						
COVID-19 vaccine hesitancy score	0.67	0.53–0.85	**0.001**	0.79	0.60–1.04	0.088
COVID vulnerability						
Friend or family member been diagnosed with COVID-19 (*n* = 484)						
Yes	1.47	1.00–2.17	**0.049**	0.99	0.96–1.02	0.573
No	Ref			Ref		
Friend or family member died due to COVID-19						
Yes	1.72	1.13–2.62	**0.012**	1.03	0.55–1.92	0.931
No	Ref			Ref		
HIV health indicators						
Number of years since HIV diagnosis (*n* = 479)	1.02	1.01–1.04	**0.007**	1.63	0.99–2.67	0.054
Viral load (*n* = 472)						
Detectable	0.57	0.36–0.91	**0.020**	1.03	0.65–1.64	0.896
Undetectable	Ref			Ref		

[a]The total sample for multi-variable logistic regression was 462 due to missing data.
aOR, adjusted odds ratio; CI, confidence interval; OR, odds ratio.
[b]*p* Values in bold < 0.05.

Table 4. Ordinal Logistic Regression Models Examining COVID-19 Vaccine Intent Among Participants in a Nationwide Survey of People Living with HIV, United States, 2021

	Vaccine intent (n = *176)*					
	OR	*95% CI*	p	*aOR*[a]	*95% CI*	p
Age	1.04	1.01–1.07	**0.003**	1.02	0.97–1.06	0.496
Sexual orientation and gender identity (*n* = 483)						
Sexual minority cisgender men	5.65	1.94–16.42	**0.001**	2.76	0.85–9.00	0.093
Nonsexual minority cisgender women	1.37	0.50–3.78	0.542	0.66	0.21–2.09	0.482
Sexual minority cisgender women	0.79	0.24–2.61	0.700	0.71	0.19–2.61	0.608
Transgender participants—all sexual orientations	2.34	0.61–8.95	0.214	1.64	0.38–7.07	0.508
Nonsexual minority cisgender men	Ref					
COVID vaccine						
COVID-19 vaccine hesitancy score	0.15	0.08–0.27	**<0.001**	0.18	0.10–0.32	**<0.001**
HIV health indicators						
Number of years since HIV diagnosis (*n* = 479)	1.04	1.01–1.07	**0.018**	1.02	0.97–1.07	0.455

[a]The total sample for the unadjusted sexual orientation and gender identity model and the multi-variable ordinal logistic regression were 174 due to missing data.
[b]*p* Values in bold < 0.05.

are recruiting POLs who are social media influencers, predominantly Black and Latinx, who will be closely engaged with their communities and who will share trusted sources of health information.[44] Given the need for trusted social media and community leaders across various sociodemographic groups, the POL approach is a promising strategy to begin dismantling government and public health mistrust.

Disparities in vaccine uptake and intent by gender and sexual orientation also were documented in this study. Uptake was highest among sexual minority cisgender men, as well transgender participants, and intent was also highest among these groups compared with SGM women and non-SGM individuals. This may be due in part to interactions with health care, especially poorer communication with non-SGM, as was found in a study of PLWH men who have sex with women.[45] Heterosexual men living with HIV may have less access to health resources, as a large proportion of HIV services are oriented toward sexual minority men,[46] and thus, straight men may not tap into the same networks that provide trusted information about COVID-19.

Other studies have also found that cisgender women are less likely than people of other genders to obtain the vaccine, citing concerns about safety and efficacy.[47] Cisgender women may be concerned about the potential effects of the COVID-19 vaccine on fertility and reproductive health,[48] although these concerns, while widespread, are not supported by scientific evidence.[49] Messaging and vaccine outreach efforts must directly address how vaccine concerns may be gendered in unique ways.

Finally, although the study presented here did not detect any differences in vaccine intent and uptake by race and ethnicity, perhaps due to smaller cell sizes for groups of color, the broader literature points to structural racism as a driver of lower vaccine uptake among minoritized communities, and White supremacy-driven disinformation as a key factor explaining vaccine hesitancy and low uptake among groups of largely conservative, White Americans.[22,50–52] Both types of mistrust require innovative strategies that do not apply blanket responses to vaccine hesitancy. For PLWH of various sociodemographic backgrounds, it is essential that communication of health information signals a genuine understanding of various communities' concerns and acts in partnership to address the hesitancies.

Limitations

The data reported in these analyses are time-bound. Given the ever-evolving nature of the COVID-19 pandemic, these findings must be nested within the time frame that the data were collected, specifically in spring 2021. This was a at a time when individuals with underlying conditions were fully eligible, namely Phase 1c, although those older than 75 years, those living in long-term care facilities, and those who were health care personnel and/or essential workers would have been eligible in the first two phases.[53] As with any self-reported data, the finding are subjected to social desirability. Still, the consistency of the data within our survey provides us with higher levels of confidence, as we also undertook procedures to prevent the infiltration of bots.[54]

Additionally, small cell sizes also require the collapsing of race and ethnicity data. However, more than 50% of the respondents did not identify as White, and thus, we achieved a relatively diverse sample. Of course, the data are dependent on accurate representation of PLWH. Given our targeted recruitment and the responses to HIV-related questions, we also have a high level of certainty in the constitution of the sample. Although cross-sectional data are always subjected to spuriousness, the findings align with the extant literature on health behaviors across sectors of PLWH. Finally, the study was limited that it was only available in English, although the survey had an elementary school reading level.

The findings of our investigation reveal the extent to which existing structural inequities have become reinforced, sustained, and amplified by the inadequate and negligent government and societal response to the COVID-19 pandemic. Vaccine outreach efforts must take special care to reach out to subgroups for whom vaccine uptake has lagged, including young PLWH, sexual minority women and nonsexual minority men living with HIV, and those who are less engaged in HIV care. To do so successfully, public health and medicine must address the particular ways misinformation might affect PLWH. Finally, ensuring uninterrupted access to HIV care, as well as increasing access for underserved populations, is a key strategy to not only facilitate progression along the HIV prevention and care continua but also provide access to trusted sources of health information that encourages vaccine uptake.

Ethical Approval

The study protocol was approved by the Institutional Review Board of Rutgers University.

Consent

Informed consent was obtained from all participants.

Author Disclosure Statement

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References

1. Halkitis PN. Managing the COVID-19 pandemic: Biopsychosocial lessons gleaned from the AIDS epidemic. J Public Health Manag Pract 2021;27:S39–S42.
2. Lopez L, 3rd, Hart LH, 3rd, Katz MH. Racial and ethnic health disparities related to COVID-19. JAMA 2021;325:719–720.
3. Centers for Disease Control and Prevention. Populations at Greatest Risk. Centers for Disease Control and Prevention, Atlanta, GA, 2020.
4. Sutton MY, Jones RL, Wolitski RJ, et al. A review of the Centers for Disease Control and Prevention's response to the HIV/AIDS crisis among blacks in the United States, 1981–2009. Am J Public Health 2009;99(S2):S351–S359.
5. Centers for Disease Control and Prevention. Risk for COVID-19 Infection, Hospitalization, and Death by Race/Ethnicity. Available at: https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html (Last accessed July 9, 2021).

6. Holmes L, Jr., Enwere M, Williams J, et al. Black-white risk differentials in COVID-19 (SARS-COV2) transmission, mortality and case fatality in the United States: Translational epidemiologic perspective and challenges. Int J Environ Res Public Health 2020;17:4322.
7. Webb Hooper M, Nápoles AM, Pérez-Stable EJ. COVID-19 and racial/ethnic disparities. JAMA 2020;323:2466–2467.
8. The Williams Institute. LGBT Proportion of Population: United States. Available at: https://williamsinstitute.law.ucla.edu/visualization/lgbt-stats/?topic=LGBT#density (Last accessed February 4, 2021).
9. Martino RJ, Krause KD, Griffin M, et al. A nationwide survey of COVID-19 testing in LGBTQ+ populations in the United States. Public Health Rep 2021;136:493–507.
10. Wenger JD, Castrodale LJ, Bruden DL, et al. 2009 Pandemic influenza A H1N1 in Alaska: Temporal and geographic characteristics of spread and increased risk of hospitalization among Alaska Native and Asian/Pacific Islander people. Clin Infect Dis 2011;52(suppl. 1):S189–S197.
11. Dee DL, Bensyl DM, Gindler J, et al. Racial and ethnic disparities in hospitalizations and deaths associated with 2009 pandemic Influenza A (H1N1) virus infections in the United States. Ann Epidemiol 2011;21:623–630.
12. Murray CJL, Lopez AD, Chin B, et al. Estimation of potential global pandemic influenza mortality on the basis of vital registry data from the 1918–1920 pandemic: A quantitative analysis. Lancet 2006;368:2211–2218.
13. Shiau S, Krause KD, Valera P, et al. The burden of COVID-19 in people living with HIV: A syndemic perspective. AIDS Behav 2020;24:2244–2249.
14. Braunstein SL, Lazar R, Wahnich A, et al. Coronavirus disease 2019 (COVID-19) infection among people with human immunodeficiency virus in New York city: A population-level analysis of linked surveillance data. Clin Infect Dis 2021;72:e1021–e1029.
15. Dorn Av, Cooney RE, Sabin ML. COVID-19 exacerbating inequalities in the US. Lancet (London, England) 2020;395:1243–1244.
16. Khubchandani J, Sharma S, Price JH, et al. COVID-19 vaccination hesitancy in the United States: A rapid national assessment. J Community Health 2021;46:270–277.
17. Bogart LM, Ojikutu BO, Tyagi K, et al. COVID-19 related medical mistrust, health impacts, and potential vaccine hesitancy among Black Americans living with HIV. J Acquir Immune Defic Syndr (1999) 2021;86:200.
18. Vallée A, Fourn E, Majerholc C, et al. COVID-19 vaccine hesitancy among French people living with HIV. Vaccines 2021;9:302.
19. Jones DL, Salazar AS, Rodriguez VJ, et al. SARS-CoV-2: Vaccine hesitancy among underrepresented racial and ethnic groups with HIV in Miami, Florida. In: Paper presented at: Open Forum Infect Dis, 2021.
20. Cornwall W. Officials gird for a war on vaccine misinformation. Science 2020;369:14–15.
21. van der Linden S, Roozenbeek J, Compton J. Inoculating against fake news about COVID-19. Front Psychol 2020;11:2928.
22. Jaiswal J, LoSchiavo C, Perlman D. Disinformation, misinformation and inequality-driven mistrust in the time of COVID-19: Lessons unlearned from AIDS denialism. AIDS Behav 2020;24:2776–2780.
23. Shapiro GK, Tatar O, Dube E, et al. The vaccine hesitancy scale: Psychometric properties and validation. Vaccine 2018;36:660–667.
24. Schneider E, Whitmore S, Glynn MK, Dominguez K, Mitsch A, McKenna MT. Revised surveillance case definitions for HIV infection among adults, adolescents, and children aged <18 months and for HIV infection and AIDS among children aged 18 months to <13 years — United States, 2008. Morbidity and Mortality Weekly Report: Recommendations and Reports. 2008 Dec 5;57:1–12.
25. Baack BN, Abad N, Yankey D, et al. COVID-19 vaccination coverage and intent among adults aged 18–39 years—United States, March–May 2021. Morbidity and Mortality Weekly Report 2021.
26. Henderson L. Mass incarceration, residential segregation and racial disparities in HIV. J AIDS HIV Res 2016;8:150–162.
27. Ibragimov U, Beane S, Adimora AA, et al. Relationship of racial residential segregation to newly diagnosed cases of HIV among black heterosexuals in US metropolitan areas, 2008-2015. J Urban Health 2019;96:856–867.
28. Yu Q, Salvador CE, Melani I, et al. Racial residential segregation and economic disparity jointly exacerbate COVID-19 fatality in large American cities. Ann N Y Acad Sci 2021;1494:18–30.
29. Edmonds A, Breskin A, Cole SR, et al. Poverty, deprivation, and mortality risk among women with HIV in the United States. Epidemiology 2021;32:877–885.
30. Trepka MJ, Fennie KP, Sheehan DM, et al. Racial-ethnic differences in all-cause and HIV mortality, Florida, 2000-2011. Ann Epidemiol 2016;26:176.e171–182.e171.
31. Feldman JM, Bassett MT. The relationship between neighborhood poverty and COVID-19 mortality within racial/ethnic groups (Cook County, Illinois). medRxiv 2020. Available at: http://doi.org/10.1101/2020.10.04.20206318.
32. Scannell Bryan M, Sun J, Jagai J, et al. Coronavirus disease 2019 (COVID-19) mortality and neighborhood characteristics in Chicago. Ann Epidemiol 2021;56:47–54.e45.
33. Bass SB, D'Avanzo P, Alhajji M, et al. Exploring the engagement of racial and ethnic minorities in HIV treatment and vaccine clinical trials: A scoping review of literature and implications for future research. AIDS Patient Care STDS 2020;34:399–416.
34. Gargano JW, Laserson K, Muttai H, et al. The adult population impact of HIV care and antiretroviral therapy in a resource poor setting, 2003-2008. AIDS 2012;26:1545–1554.
35. Pinto RM, Park S. COVID-19 pandemic disrupts HIV continuum of care and prevention: Implications for research and practice concerning community-based organizations and frontline providers. AIDS Behav 2020;24:2486–2489.
36. Ridgway JP, Schmitt J, Friedman E, et al. HIV care continuum and COVID-19 outcomes among people living with HIV during the COVID-19 pandemic, Chicago, IL. AIDS Behav 2020;24:2770–2772.
37. Malik AA, McFadden SM, Elharake J, et al. Determinants of COVID-19 vaccine acceptance in the US. EClin Med 2020;26:100495.
38. Nguyen KH, Srivastav A, Razzaghi H, et al. COVID-19 vaccination intent, perceptions, and reasons for not vaccinating among groups prioritized for early vaccination—United States, September and December 2020. Am J Transplant 2021;21:1650–1656.
39. Niepel C, Kranz D, Borgonovi F, et al. The coronavirus (COVID-19) fatality risk perception of US adult residents

in March and April 2020. Br J Health Psychol 2020;25: 883–888.
40. Lau JS, Adams SH, Irwin CE, Jr., et al. Receipt of preventive health services in young adults. J Adolesc Health 2013;52:42–49.
41. Centers for Disease Control and Prevention. COVID-19 Vaccinations in the United States. Available at: https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total (Last accessed October 13, 2021).
42. Dyer O. Covid-19: Trump stokes protests against social distancing measures. BMJ 2020;369:m1596.
43. Kalichman SC, Shkembi B, Kalichman MO, et al. Trust in health information sources and its associations with COVID-19 disruptions to social relationships and health services among people living with HIV. BMC Public Health 2021;21:1–12.
44. Quinn KG. Applying the popular opinion leader intervention for HIV to COVID-19. AIDS Behav 2020;24:3291–3294.
45. Zhang C, McMahon J, Leblanc N, et al. Association of medical mistrust and poor communication with HIV-related health outcomes and psychosocial wellbeing among heterosexual men living with HIV. AIDS Patient Care STDS 2020;34:27–37.
46. Martos AJ, Wilson PA, Meyer IH. Lesbian, gay, bisexual, and transgender (LGBT) health services in the United States: Origins, evolution, and contemporary landscape. PLoS One 2017;12:e0180544.
47. Callaghan T, Moghtaderi A, Lueck JA, et al. Correlates and disparities of intention to vaccinate against COVID-19. Soc Sci Med 2021;272:113638.
48. Goncu Ayhan S, Oluklu D, Atalay A, et al. COVID-19 vaccine acceptance in pregnant women. Int J Gynaecol Obstet 2021;154:291–296.
49. Shimabukuro TT, Kim SY, Myers TR, et al. Preliminary findings of mRNA Covid-19 vaccine safety in pregnant persons. N Engl J Med 2021;384:2273–2282.
50. KFF COVID-19 Vaccine Monitor. Available at: https://www.kff.org/coronavirus-covid-19/dashboard/kff-covid-19-vaccine-monitor-dashboard (Last accessed August 1, 2021).
51. Louie V, Viladrich A. ''Divide, divert, & conquer'' deconstructing the presidential framing of white supremacy in the COVID-19 era. Soc Sci 2021;10:280.
52. Yamey G, Gonsalves G. Donald Trump: A political determinant of covid-19. BMJ 2020;369:m1643.
53. Dooling K, Marin M, Wallace M, et al. The advisory committee on immunization practices' updated interim recommendation for allocation of COVID-19 vaccine—United States, December 2020. MMWR Morb Mortal Wkly Rep 2021;69:1657–1660.
54. Griffin M, Martino RJ, LoSchiavo C, et al. Ensuring survey research data integrity in the era of internet bots. Qual Quant 2021, DOI: 10.1007/s11135-021-01252-1.

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