Associations between COVID-19 vaccine uptake, race/ethnicity, and political party affiliation

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Abstract
Despite widespread availability of vaccines, COVID-19 is a leading cause of death in the United States (US), and sociodemographic disparities in vaccine uptake remain. Race/ethnicity, partisanship, and perception of peer vaccination status are strong predictors of vaccine uptake, but research is limited among some racial/ethnic groups with small populations. The current study used an online survey to examine the relationship between these factors among a diverse sample of US adults (n = 1,674), with oversampling of racial and ethnic minorities. Respondents provided sociodemographic information and answered questions regarding COVID-19 vaccination status, political affiliation, perception of peers’ vaccination status, COVID-19 death exposure, and previous COVID-19 infection. Respondents who identified as Asian American had higher odds of being vaccinated, whereas those who identified as Black/African American or American Indian or Alaska Native (AIAN) had lower odds. Respondents who identified as Independent/Other or Republican had lower vaccination odds. Respondents who perceived anything less than nearly all of their peers were vaccinated had lower vaccination odds. Further, lack of a primary care provider, younger age, and lower educational attainment were associated with lower vaccination odds. Findings may help to determine where additional work is needed to improve vaccine uptake in the US. Results indicate the need for intentional and tailored vaccination programs in Black/African American and AIAN communities; the need to understand how media and political actors develop vaccination messaging and impact vaccine uptake; and the need for additional research on how people estimate, understand, and form decisions around peer vaccination rates.

Keywords COVID-19 vaccine · Vaccine uptake · Racial and ethnic minorities · Political affiliation · Peer vaccination status

Introduction
Despite widespread availability of COVID-19 vaccines, COVID-19 is a leading cause of death in the United States (US) (Ahmad & Anderson, 2021). Although vaccines have helped to reduce morbidity and mortality, sociodemographic disparities in vaccine uptake remain, particularly among racial and ethnic groups who have already experienced disproportionately higher rates of COVID-19 infection and death (Magesh et al., 2022; Ndugga et al., 2022; Reitsma et al., 2022). Research has consistently demonstrated higher rates of vaccine hesitancy among Black/African American adults, who currently have the lowest COVID-19 vaccination rates in the US compared with other racial/ethnic groups (Daly et al., 2021; Ndugga et al., 2022; Reitsma et al., 2022; Willis et al., 2021). Studies involving other racial and ethnic minorities disproportionately affected by the COVID-19 pandemic, including Asian American, Native Hawaiian or Pacific Islander (NHPI), and American Indian or Alaska Native (AIAN) individuals, are lacking or have provided mixed findings. Where data was available, studies found that AIAN have the second-highest vaccination
rate among racial/ethnic minorities in the US (Foxworth et al., 2021; Hill & Artiga, 2021); however, this finding is not often reported in vaccine uptake literature, most likely due to combining multiple, smaller racial and ethnic minority populations into singular groups with the label “other race/ethnicity.” Studies have noted similarly high vaccination rates among Asian American populations, with Asian American communities having the highest COVID-19 vaccine uptake rates among racial/ethnic minorities in the US (Niño et al., 2021), but these studies did not distinguish between sub-populations within the racial/ethnic group. For example, one such study combined Asian (6.1% of the US population) with NHPI (0.3% of the US population) (Niño et al., 2021). Data aggregation may be masking nuances in COVID-19 vaccine uptake findings (Ta Park et al., 2021).

Although racial/ethnic health disparities in vaccine uptake still exist, they have narrowed over time (Daly et al., 2021), and other sociodemographic gaps in vaccine uptake have widened. One of these increasingly widening gaps is the divide in political party affiliation in relation to vaccine uptake. Politicization and polarization in early COVID-19 media coverage may have contributed to polarization in US attitudes about the COVID-19 pandemic (Hart et al., 2020), extending to attitudes about COVID-19 vaccines. Recent studies indicate that political partisanship has become a stronger predictor of vaccination status than factors such as age, race, education, or insurance status, with Republicans making up a disproportionate share of those who have not received the COVID-19 vaccine (Kirzinger et al., 2021). Other studies have indicated that political ideology has a direct effect on vaccine attitudes, with conservative respondents being less likely to express pro-vaccination beliefs (Baumgaertner, 2022) and more likely to endorse vaccine misinformation (Motta, 2021).

Further complicating the disparities in vaccine uptake by race/ethnicity and political affiliation is the influence of peers on vaccine uptake. A study of California prison custody and health care staff provided evidence of lower vaccine uptake among staff who live and work among primarily unvaccinated populations (Prince et al., 2022). Additionally, a study of undergraduate students from a large public university in the northwest US illustrated that those who perceived more of their peers would choose to be vaccinated against influenza or COVID-19 reported being more likely to choose vaccination for themselves (Abdallah & Lee, 2021). Research on influenza vaccination finds that vaccination is more likely among individuals who perceive the majority of the people around them as wanting to be vaccinated (Quinn et al., 2017). Given the potential for underestimating the vaccination behaviors of others (Abdallah & Lee, 2021), especially among those in minoritized populations or in environments where political partisanship is especially salient, perceptions of low peer vaccination may further lower vaccine uptake.

Considering that race/ethnicity, partisanship, and perception of peer vaccination status have been found to be strong predictors of vaccine uptake, and that there is limited research among some racial/ethnic groups with small populations, the current study sought to examine the relationship between these factors among a diverse sample of US adults. Providing a nuanced and specific understanding of the role these factors play in vaccine uptake may help to provide more detailed, targeted, and specific vaccine messaging strategies to encourage COVID-19 vaccination uptake among unvaccinated populations.

**Methods**

Invitations to participate in an online survey were emailed to individuals in an online opt-in panel of individuals managed by 4media Group. The survey was available in both English and Spanish. The email invitation included the following information about the study: (1) the estimated study duration (10 min); (2) potential risks and benefits; (3) the voluntary nature of participation; and (4) confidentiality of responses. Respondents indicated consent by agreeing to participate in the survey. A total of 2,022 US adults were recruited between September 7, 2021 and October 3, 2021.

The institutional review board for the protection of human subjects at the University of Arkansas for Medical Sciences (IRB #263020) approved the study procedures.

We oversampled Asian American, Black/African American, Hispanic/Latino, AIAN, and NHPI individuals. This oversampling was necessary to avoid aggregation of racial and ethnic groups, which often obscures diverse groups, experiences, and attitudes (Chang et al., 2020; Gee et al., 2022). The random iterative method (Mercer et al., January 26, 2018.) was used to weight the data to be representative of the US population across key demographic variables including gender (men, women, non-binary), race/ethnicity, and age (18–24, 25–34, 35–44, 45–54, 55–64, 65+).

The sample was limited to respondents who completed the entire survey. Of the 2,022 adult respondents, 1,674 respondents are included in the final analytic sample. Political affiliation (9.5%), knowing someone who died of COVID-19 (4.4%), and previous COVID-19 infection (3.4%) had the highest percentage of missing responses.
Measures

Vaccination status

Vaccination status was determined by the response to the question, “Have you received a COVID-19 vaccine?” with a dichotomous response option of yes or no.

Political affiliation

Political affiliation was determined by the response to the question, “Generally speaking, do you consider yourself as a…?” with response options of Democrat, Republican, Independent, or Other. Independent and Other categories were combined due to the low number of responses.

Perception of peer vaccination status

Respondents were asked of the people close to them, how many they believed had been vaccinated. Response options included that they believed very few people, some people but not many, many people, or nearly all people they know had been vaccinated.

COVID-19 related factors

Respondents were asked if they had previously been infected by COVID-19 (yes/no) or if they know anyone who had died from COVID-19 (yes/no).

Sociodemographic characteristics

Sociodemographic information collected included age, gender, and education. Age (18–34, 35–44, and 45+) and gender (man, woman, non-binary, or self-described) were categorical variables; however, only a few of the respondents selected a non-binary gender or self-described, and therefore, the analytic sample included only self-identified men and women. Education was measured by asking respondents their highest degree or level of school completed; respondents with less than high school and only some high school were combined with high school graduates, and those with a bachelor’s degree or higher were similarly combined due to low frequency of responses for some education levels. Employment status was dichotomized to those working for wages and those who were not, such as students, retirees, and those temporarily out of work. Respondents were also asked to report their insurance status (insured/uninsured) and whether they had a primary care provider (yes/no).

Analysis

Using the appropriate survey weights, descriptive statistics (frequencies and proportions) were used to characterize the sample. Due to the low number of unvaccinated respondents, multivariate complementary log-log regression was used to determine the odds ratios (OR) for the variables of interest. Analysis was completed using STATA 17.0, and a p value of 0.05 or less was considered statistically significant.

Results

Sample characteristics

Table 1 reports the weighted sample characteristics. 73% of the sample reported having received at least one dose of the COVID-19 vaccine. 54% of the participants were 45 or older, 30% were between the ages of 18 and 34, and 16% were between the ages of 35 and 44. The sample was evenly split between men and women. 38% of the sample had a bachelor’s degree or more, and 28% had a high school education or less. The majority of the sample (58%) were unemployed at the time of the survey; however, 87% were insured, and 81% had a primary care provider. A quarter of participants reported knowing someone who died of COVID-19, and the majority (82%) had not been previously infected with COVID-19.

40% of the sample identified as White, 20% identified as Black/African American, and 20% identified as Hispanic/Latino. 10% of the sample identified as Asian American, 5% of the sample identified as NHPI, and an additional 5% identified as AIAN. 45% of the sample identified as Democrat, 23% identified as Republican, and 32% identified as Independent/Other. 10% of the sample reported they perceived very few people they know had been vaccinated, 23% reported some but not many had been vaccinated, 37% said many had been vaccinated, and 29% stated that nearly all of the people they know had been vaccinated.

Table 2 reports the results of the multivariate log-log regression exploring the odds of vaccination among respondents. Adults who were 45 or older had 1.35 times higher odds of being vaccinated (p = .006) than those between the ages of 18 and 34. Odds of vaccination increased as educational attainment increased; respondents with an associate degree had 1.31 times higher odds of vaccination (p = .049), and those with a bachelor’s degree or higher had 1.41 times higher odds of vaccination (p = .003) than those with high school education or less. Respondents without a primary care provider had lower odds of being vaccinated (OR = 0.68, p = .002). Respondents who reported knowing someone who died from COVID-19 had higher odds of
had previously been infected with COVID-19 had lower odds of vaccination (OR = 0.75, p = .011). There were no statistical differences in the odds of vaccination by gender, employment, or insurance status.

Compared to respondents who identified as White, respondents who identified as Asian had 1.49 times higher odds of vaccination (p = .005), whereas odds of vaccination decreased by 30% for respondents who identified as Black/African American (p = .002) and by 74% for those who identified as AIAN (p = .001). Respondents who identified as Independent/Other (OR = 0.64, p < .001) or Republican (OR = 0.63, p < .001) had lower odds of vaccination compared to respondents who identified as Democrat. The odds of vaccination decreased for respondents who stated many (OR = 0.53, p < .001), some but not many (OR = 0.36, p < .001), or very few (OR = 0.16, p < .001) of the people they know were vaccinated compared with respondents

| Table 1 Weighted Proportions of Sample Characteristics, N = 1,674 | Proportion | SE  | [95% CI] |
|---------------------|------------|-----|----------|
| **Vaccination status** |            |     |          |
| Not vaccinated      | 0.27       | 0.01| [0.25, 0.29] |
| Vaccinated          | 0.73       | 0.01| [0.71, 0.75] |
| **Age**             |            |     |          |
| 18–34               | 0.30       | 0.01| [0.28, 0.32] |
| 35–44               | 0.16       | 0.01| [0.14, 0.18] |
| 45+                 | 0.54       | 0.01| [0.52, 0.57] |
| **Gender**          |            |     |          |
| Men                 | 0.50       | 0.01| [0.48, 0.53] |
| Women               | 0.50       | 0.01| [0.47, 0.53] |
| **Race/Ethnicity**  |            |     |          |
| Asian American      | 0.10       | 0.01| [0.09, 0.11] |
| Black/African American | 0.20   | 0.01| [0.18, 0.22] |
| Hispanic/Latino     | 0.20       | 0.01| [0.18, 0.22] |
| AIAN                | 0.05       | 0.004| [0.04, 0.06] |
| NHPI                | 0.05       | 0.004| [0.04, 0.06] |
| White               | 0.40       | 0.01| [0.37, 0.43] |
| **Education**       |            |     |          |
| High school or less | 0.28       | 0.01| [0.26, 0.31] |
| Some college/No degree | 0.21  | 0.01| [0.19, 0.24] |
| Associate           | 0.13       | 0.01| [0.11, 0.14] |
| Bachelor’s or graduate | 0.38  | 0.01| [0.35, 0.40] |
| **Employment**      |            |     |          |
| Not employed for wages | 0.58 | 0.01| [0.56, 0.61] |
| Employed for wages  | 0.42       | 0.01| [0.39, 0.44] |
| **Insurance status**|            |     |          |
| Uninsured           | 0.13       | 0.01| [0.12, 0.15] |
| Insured             | 0.87       | 0.01| [0.85, 0.89] |
| **Has a primary care provider** | | | |
| Yes                 | 0.81       | 0.01| [0.79, 0.83] |
| No                  | 0.19       | 0.01| [0.17, 0.21] |
| **Do you know someone who has died from COVID-19?** | | | |
| No                  | 0.75       | 0.01| [0.73, 0.77] |
| Yes                 | 0.25       | 0.01| [0.23, 0.27] |
| **Have you had COVID-19?** | | | |
| Have not had COVID-19 | 0.82   | 0.01| [0.80, 0.84] |
| Had COVID-19        | 0.18       | 0.01| [0.16, 0.20] |
| **Political affiliation** | | | |
| Democrat            | 0.45       | 0.01| [0.42, 0.47] |
| Independent/Other   | 0.32       | 0.01| [0.30, 0.35] |
| Republican          | 0.23       | 0.01| [0.21, 0.26] |
| **How many people do you know who have been vaccinated?** | | | |
| Very few            | 0.10       | 0.01| [0.09, 0.12] |
| Some but not many   | 0.23       | 0.01| [0.22, 0.26] |
| Many                | 0.37       | 0.01| [0.35, 0.39] |
| Nearly all          | 0.29       | 0.01| [0.27, 0.31] |

Notes: AIAN = American Indian or Alaska Native; CI = confidence interval; NHPI = Native Hawaiian or Pacific Islander; OR = odds ratio; SE = standard error.

| Table 2 Multivariate Complementary Log-Log Regression of the Odds of Vaccination, N = 1,674 | OR   | SE  | [95% CI] | p    |
|---------------------------------|------|-----|----------|------|
| **Age (ref = 18–34)**           |      |     |          |      |
| 35–44                           | 1.03 | 0.13| [0.81, 1.31] | 0.819 |
| 45+                             | 1.35 | 0.15| [1.09, 1.67] | **0.006** |
| **Women**                       |      |     |          |      |
|                                | 1.08 | 0.09| [0.92, 1.27] | 0.363 |
| **Education (ref = High school or less)** | | | | |
| Some college/No degree          | 1.07 | 0.13| [0.85, 1.35] | 0.547 |
| Associate                       | 1.31 | 0.18| [1.00, 1.71] | **0.049** |
| Bachelor’s or graduate          | 1.41 | 0.16| [1.12, 1.78] | **0.003** |
| Employed for wages              | 1.14 | 0.10| [0.95, 1.36] | 0.155 |
| Insured                         | 1.07 | 0.15| [0.81, 1.43] | 0.598 |
| No primary care provider        | 0.68 | 0.08| [0.54, 0.87] | **0.002** |
| **Knows someone who died of COVID-19** | | | | |
|                                | 1.40 | 0.14| [1.15, 1.71] | **0.001** |
| **Had COVID-19**                |      |     |          |      |
|                                | 0.75 | 0.09| [0.60, 0.94] | **0.011** |
| **Race/Ethnicity (ref = White)**| | | | |
| Asian American                  | 1.49 | 0.21| [1.13, 1.98] | **0.005** |
| Black/African American          | 0.70 | 0.08| [0.55, 0.88] | **0.002** |
| Hispanic/Latino                 | 0.88 | 0.11| [0.70, 1.11] | 0.29  |
| AIAN                            | 0.26 | 0.09| [0.47, 0.83] | **0.001** |
| NHPI                            | 0.90 | 0.15| [0.65, 1.23] | 0.50  |
| **Political affiliation (ref = Democrat)** | | | | |
| Independent/Other               | 0.64 | 0.06| [0.53, 0.77] | < **0.001** |
| Republican                      | 0.63 | 0.08| [0.50, 0.80] | < **0.001** |
| **How many people do you know who have been vaccinated?** (ref = Nearly all) | | | | |
| Very few                        | 0.16 | 0.03| [0.11, 0.23] | < **0.001** |
| Some but not many               | 0.36 | 0.04| [0.29, 0.46] | < **0.001** |
| Many                            | 0.53 | 0.06| [0.43, 0.65] | < **0.001** |
| Constant                        | 2.58 | 0.59| [1.65, 4.03] | < **0.001** |

Notes: AIAN = American Indian or Alaska Native; CI = confidence interval; NHPI = Native Hawaiian or Pacific Islander; OR = odds ratio; SE = standard error.
who perceived nearly all of the people they know have been vaccinated.

Discussion

The results of our study illustrate the influence of race/ethnicity, political affiliation, and perceptions of peer vaccination status on vaccination status. Respondents who identified as Asian American had higher odds of reporting being vaccinated, whereas those who identified as Black/African American or AIAN had lower odds of being vaccinated. Further, respondents who identified as Independent/Other or Republican had lower odds of being vaccinated. Respondents who perceived anything less than nearly all of their peers were vaccinated had lower odds of vaccination. The findings of this study are an important picture of where more work is needed to improve vaccination uptake in the US. Sociodemographic disparities in vaccine uptake remain, including by age and education.

Certain racial and ethnic groups have experienced disproportionately higher rates of COVID-19 infection and death (Magee et al., 2022; Ndugga et al., 2022; Reitsma et al., 2022). Prior work has demonstrated that Black/African American adults have the lowest COVID-19 vaccination rates in the US compared to other races/ethnicities (Daly et al., 2021; Ndugga et al., 2022; Reitsma et al., 2022; Willis et al., 2021). The results of this study support prior research demonstrating the continued importance of addressing the sources of vaccine hesitancy in the Black/African American community to increase vaccination rates, including experiences of discrimination (Willis et al., 2022). Further, our study is one of the first to allow for the disaggregation of race/ethnicity into smaller categories to understand vaccine uptake. Our findings support previous work showing that those who identify as Asian American have the highest COVID-19 vaccine uptake rates among racial/ethnic minorities in the US (Niño et al., 2021). Previous studies have found that AIAN have the second-highest vaccination rate among racial/ethnic minorities in the US (Foxworth et al., 2021; Hill & Artiga, 2021); however, our findings show respondents who identified as part of the AIAN population had lower odds of vaccination than those who identified as White. It is difficult to know why our results are different from other studies. It is possible that respondents living in the community setting were disconnected from the education and resources provided by Indian Health Services, increasing vaccine hesitancy and reducing vaccine uptake.

Additionally, although other studies have found members of the NHPI community to be more vaccine hesitant than other Asian American groups (Ta Park et al., 2021), our results show that those who identify as NHPI do not have statistically different odds of vaccination than their White counterparts. Our findings support the need to ensure study designs include large enough sample sizes to disaggregate racial/ethnic groups during analysis. Further, the findings indicate the need for more intentional and tailored vaccination programs in Black/African American and AIAN communities.

The results show a divide in political party affiliation in relation to vaccine uptake. The politicization of COVID-19 does seem to have contributed to polarization in US attitudes about COVID-19 vaccines, reducing the odds of vaccination in those who identify as Republican or as Independent/Other. Studies have shown political partisanship has become a stronger predictor of vaccination status than factors such as age, race, or education (Kirzinger et al., 2021); however, our results show that these factors still influence vaccine uptake even when accounting for political affiliation. Still, political identity has a direct effect on vaccine attitudes. Further work is needed to understand how political affiliation influences vaccine uptake through its impact on perception as well as the uptake of trusted information in an increasingly fractured (and fractious) media environment (Bartels, 2002). This work includes understanding how agenda setting (McCombs et al., 2014) and framing (Tewksbury & Scheufele, 2009) are utilized by political figures and news media when discussing COVID-19 vaccination and COVID-19 infection. Additionally, there is a need for public health officials to find means to convey information to populations who may be hesitant to accept their recommendations.

Similar to prior studies (Abdallah & Lee, 2021; Prince et al., 2022), our results provide evidence of lower vaccine uptake among those who perceived their peers would not choose to be vaccinated against COVID-19. Given the potential for underestimating the vaccination behaviors of others (Abdallah & Lee, 2021), additional work is needed to understand how people estimate the vaccination rate among their peers and to determine the accuracy of these assumptions.

Further, lack of a primary care provider, younger age, and lower educational attainment were associated with lower odds of vaccination. These results support prior research showing that younger adults, adults with lower levels of educational attainment, and those without a primary care provider are less likely to be vaccinated (McElfish et al., 2022; Wang et al., 2021).

There are limitations to keep in mind while interpreting these results. The methods used to develop the sample for this study were not random due to oversampling of marginalized groups, limiting the generalizability of this study to the wider population. Additionally, the study used cross-sectional data, and therefore, we are unable to establish causal
relationships. Despite their many advantages, online surveys often suffer from low participation among minoritized racial and ethnic groups. We anticipated this limitation and addressed it by oversampling minoritized racial and ethnic groups in large numbers to ensure their representation in the study. We rely on self-report for vaccination status, political affiliation, and perception of peer vaccination, which does leave open the potential for bias. We attempted to mitigate bias by using validated measures.

Conclusion

The findings of this study are an important part of determining where additional work is needed to improve vaccination uptake in the US. It is one of the only studies with an oversample of racial/ethnic minorities, allowing for a more nuanced picture of vaccine uptake. The results indicate the need for intentional and tailored vaccination programs in Black/African American and AIAN communities. Further, there is a need to understand how the media and political actors use agenda setting and framing in developing messaging related to vaccination and how this messaging relates to vaccine uptake. Finally, there is a need for additional research to understand how people estimate the vaccination rate among their peers, the accuracy of these assumptions, and how those assumptions feed into vaccine uptake.

Authors’ Contributions

Jennifer A. Andersen: Conceptualization, Methodology, Validation, Formal Analysis, Writing - Original Draft, Writing - Review & Editing, Supervision; Erin Gloster: Conceptualization, Writing - Original Draft, Writing - Review & Editing; Brett Rowland: Validation, Formal Analysis, Writing - Review & Editing; Spencer Hall: Validation, Formal Analysis, Writing - Review & Editing; Don E. Willis: Investigation, Data Curation, Writing - Review & Editing, Project Administration; Shashank S. Kraleti: Writing - Review & Editing; Pearl A. McElfish: Writing - Review & Editing, Supervision, Funding Acquisition

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Data Availability

The deidentified data underlying the results presented in this study may be made available upon reasonable request from the corresponding author, Pearl A. McElfish, at pamecelfish@uams.edu.

Code Availability

N/A.

Declarations

Conflict of Interest

The authors declared no conflicts of interest.

Ethics Approval

The institutional review board for the protection of human subjects at the University of Arkansas for Medical Sciences (IRB #263020) approved the study procedures.

Consent to Participate

Invitations to participate in an online survey were emailed to individuals in an online registry of research volunteers. The email invitation included the following information about the study: (1) the estimated study duration (10 min); (2) potential risks and benefits; (3) the voluntary nature of participation; and (4) confidentiality of responses. Respondents indicated consent by agreeing to participate in the survey.

Consent for Publication

N/A.

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