



## Short communication

# COVID-19 vaccination willingness and uptake among low-income Black/African American, Latino, and White adults living in the U.S

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## ABSTRACT

The purpose of this study was to assess differences in COVID-19 vaccine willingness and uptake between low-income and non-low-income adults and across race-ethnicity. We utilized data from the COVID-19's Unequal Racial Burden online survey, which included baseline (12/17/2020–2/11/2021) and 6-month follow-up (8/13/2021–9/9/2021) surveys. The sample included 1,500 Black/African American, Latino, and White low-income adults living in the U.S. (N = 500 each). A non-low-income cohort was created for comparison (n = 1,188). Multinomial logistic regression was used to assess differences in vaccine willingness and uptake between low-income and non-low-income adults, as well as across race-ethnicity (low-income adults only). Only low-income White adults were less likely to be vaccinated compared to their non-low-income counterparts (extremely willing vs. not at all: OR = 0.58, 95% CI = 0.39–0.86); low-income Black/African American and Latino adults were just as willing or more willing to vaccinate. At follow-up, only 30.2% of low-income adults who reported being unwilling at baseline were vaccinated at follow-up. White low-income adults (63.6%) appeared less likely to be vaccinated, compared to non-low-income White adults (80.9%), low-income Black/African American (70.7%), and low-income Latino adults (72.4%). Distrust in the government (46.6), drug companies (44.5%), and vaccine contents (52.1%) were common among those unwilling to vaccinate. This prospective study among a diverse sample of low-income adults found that low-income White adults were less willing and less likely to vaccinate than their non-low-income counterparts, but this difference was not observed for Black/African American or Latino adults. Distrust and misinformation were prevalent among those who remained unvaccinated at follow-up.

## 1. Introduction

Disparities in COVID-19 vaccination, as well as other COVID-19 prevention behaviors, exist between high- and lower-income individuals and communities in the United States. (Brownstein et al., 2022; Cheng and Li, 2022; Wachira et al., 2022) Racial-ethnic disparities in vaccine willingness and uptake have also been observed. (Pingali et al., 2021; Nápoles et al., 2021) However, less is known about how income disparities and racial-ethnic disparities in COVID-19 vaccine willingness and uptake intersect. Thus, the goal of this study was to assess 1) differences in vaccination willingness and uptake between low-income and non-low-income adults, 2) racial-ethnic differences in vaccine willingness and uptake in low-income adults, and 3) identify vaccine concerns among unvaccinated low-income adults.

## 2. Methods

### 2.1. Survey design and study population

We utilized baseline (12/17/2020–2/11/2021) and 6-month follow-up data (8/13/2021–9/9/2021) from the COVID-19's Unequal Racial Burden (CURB) online survey, which was conducted to measure the social, behavioral, and economic impact of the COVID-19 pandemic among diverse populations. (Nápoles et al., 2021) The Pfizer-BioNTech and Moderna COVID-19 vaccines were approved for emergency use authorization during the baseline survey period; however, initial rollout was slow and vaccines were prioritized for adults in high-risk settings (e.g., healthcare providers) (The COVID-19 "Vaccination Line": An Update on State Prioritization Plans. Kaiser Family Foundation, 2012) or with

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high-risk conditions (e.g., heart disease, cancer) ([States Set Different COVID-19 Vaccination Priorities for People with High-Risk Conditions, 2021](#)). Vaccines became available to all individuals  $\geq 16$  years old in all 50 states and Washington, D.C by April 19, 2021 ([Schumaker, 2021](#)).

The baseline CURB survey consisted of three separate cohorts, two of which were used in this analysis: a nationally representative sample of all adults living in the U.S. (main sample,  $n = 5,500$ ), a nationally representative sample of low-income Black/African American, Latino, and White adults (low-income sample,  $n = 1,500$ ), and a nationally representative sample of rural Black/African American, Latino, and White low-income adults (rural sample [not included in current study],  $n = 1,500$ ). Samples were mutually exclusive, so in total 8,500 participants were included.

Additional information on the development of the CURB survey has been detailed elsewhere ([Nápoles et al., 2021](#)). Briefly, survey participants were recruited from the YouGov proprietary, opt-in survey panel comprised of over 1.8 million US residents. To obtain a nationally representative sample of low-income adults, YouGov generated a theoretical cohort (target sample) of 1,500 low-income adults using the 2018 American Community Survey. Eligible panel members identified as being low-income (i.e., living below the 2019 US Census poverty threshold based on self-reported household size and annual household income) were proximity matched to the target sample until quotas were met using race-ethnicity, gender, age, education, and language preference (Latino only). Survey weights for each racial-ethnic group were then calculated using multivariable logistic regression, adjusting for age, gender, education, and Census region. Overall, this combination of weighting and matching allowed us to generate nationally representative cohorts of low-income adults within each racial-ethnic group.

The same methods were used to generate the nationally representative main sample. We then created a non-low-income comparison group by identifying non-low-income Black/African American ( $n = 361$ ), Latino ( $n = 318$ ), and White ( $n = 509$ ) participants from the main sample. Additional weights for the non-low-income comparison group were calculated to generate nationally representative samples for each racial-ethnic group.

## 2.2. Vaccine willingness, uptake, and concerns

At baseline, all participants were asked “If a COVID-19 vaccine becomes available, how likely are you to get vaccinated?” with the response options: not at all likely; slightly likely; moderately likely; very likely; and extremely likely. At follow-up participants were asked “How would you describe your personal situation regarding COVID-19 vaccines?” with the response options: I am fully vaccinated against COVID-19; I have started the vaccination process, but need another shot; I plan to get vaccinated; I will not get vaccinated; and I’m not sure about getting vaccinated. Both vaccine willingness (not at all likely, unsure [slightly/moderately/very likely], extremely likely) and vaccination status (vaccinated [fully or partially], unsure/plan to, will not vaccinate) were collapsed into 3-level variables for analysis. Vaccine status was also dichotomized: vaccinated (fully or partially) vs. not vaccinated.

At follow-up, unvaccinated participants were asked about their vaccine concerns. Concerns included: I have concerns about the cost; I do not know where to get the vaccine; I have concerns about its safety; I have concerns about how effective it will be in general; I have concerns about how effective it will be against the new variants; I have concerns about side effects; I plan to wait and see if it is safe and may get it later; I don’t believe I need a COVID-19 vaccine; I don’t like vaccines; My doctor has not recommended it; I don’t trust the government; I don’t trust the drug companies that developed the COVID-19 vaccines; I don’t trust the contents of the COVID-19 vaccines; I don’t trust the healthcare system; Other (specify); and I have no concerns about getting the vaccine. Unvaccinated individuals were also asked an open-ended question if there was anything that might help change their mind about being vaccinated (write-in). Responses that included “no” or “nothing” (e.g.,

“No, I will not compromise my beliefs”, “Nothing will convince me to inject poisonous and DNA-altering substances into my body”) were flagged and counted.

## 2.3. Statistical analyses

Chi-square tests were used to compare vaccine willingness between low-income and non-low-income adults, as well as across race-ethnicity (low-income adults only). Multinomial logistic regression was used to compare the odds of being unsure or extremely willing, versus not at all willing to vaccinate, between low-income and non-low-income adults. Models were adjusted for age, gender, health insurance, self-rated physical health, education, and chronic conditions associated with increased risk of COVID-19 morbidity and mortality (cancer diagnosis within the past year, chronic obstructive pulmonary disease, chronic kidney disease, diabetes, heart conditions, immunocompromised from transplant, obesity, and sickle cell anemia). Interaction terms were used to assess whether associations between low-income status and vaccine willingness differed by race-ethnicity. All baseline analyses were weighted to obtain nationally representative estimates; counts were rounded for interpretation.

Chi-square tests were also used to compare differences in vaccination status at follow-up between low-income and non-low-income adults. Sankey plots were used to visualize the relationship between baseline vaccine willingness and subsequent uptake. Due to the smaller sample size at follow-up, analyses of follow-up data were unweighted.

Analyses were performed using SAS version 9.4 (SAS Inc., Cary, NC). The National Institutes of Health Office of IRB Operations determined that this study does not qualify as human subjects research because YouGov provided de-identified data.

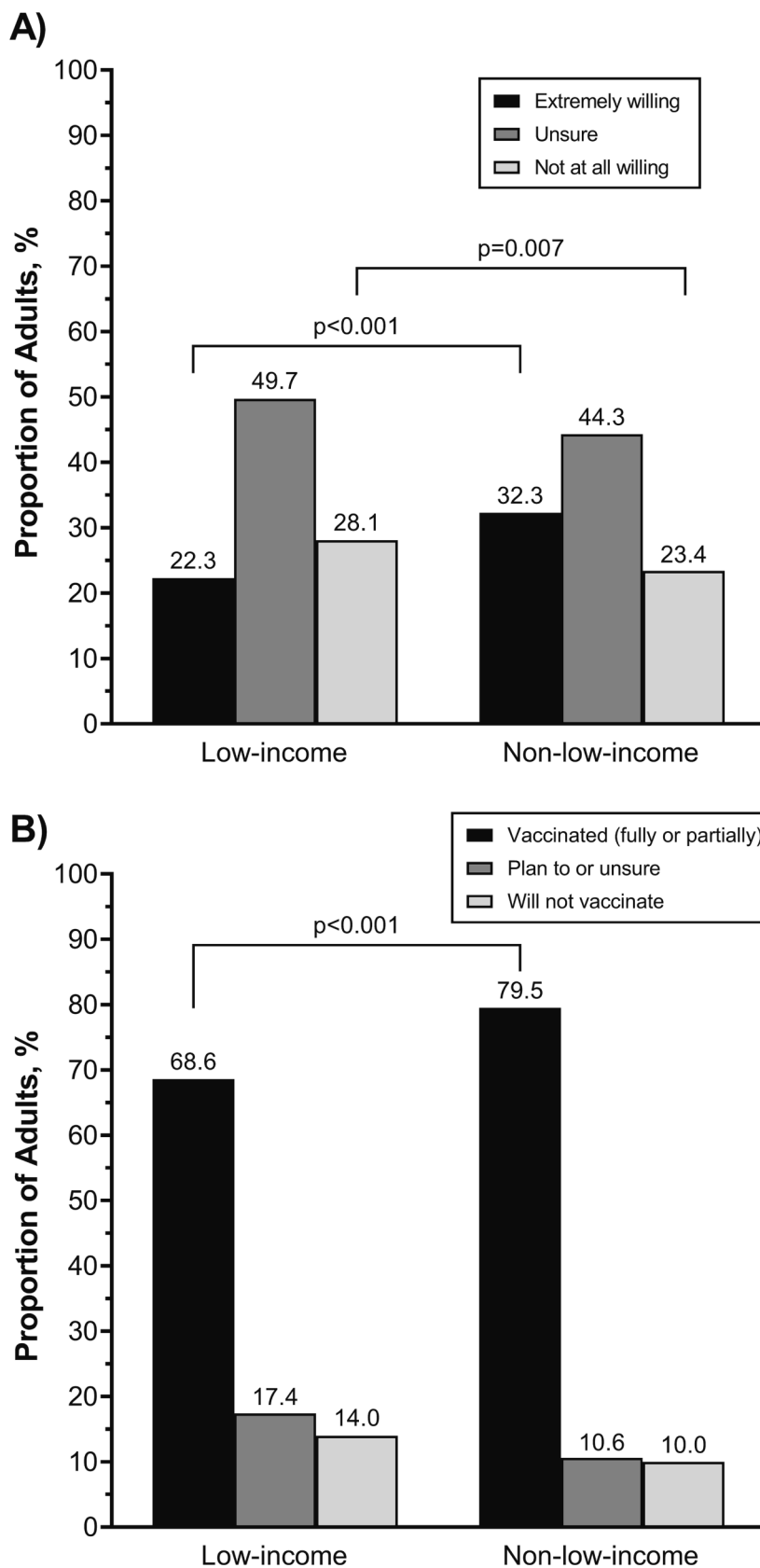
## 3. Results

Demographic characteristics, stratified by race-ethnicity, are reported in [Supplemental Table 1](#).

At baseline, low-income adults were less likely to be extremely willing to vaccinate (22.3% vs. 32.3%,  $p < 0.0001$ ) compared to non-low-income adults, [Fig. 1A](#). After stratifying by race-ethnicity, only low-income White adults were less likely to be extremely willing to vaccinate (adjusted odds ratio [aOR] = 0.58, 95% CI = 0.39–0.86), compared to non-low-income White adults; low-income Latino adults were more likely to be extremely willing to vaccinate (aOR = 1.64, 95% CI = 1.03–2.61) and no differences were seen between low-income and non-low-income Black/African American adults (aOR = 0.90, 95% CI = 0.58–1.40), [Supplemental Table 2](#).

By September 2021, over two-thirds of low-income participants had received at least one dose of a COVID-19 vaccine; however, low-income adults were less likely to be vaccinated compared to their non-low-income counterparts (68.6% vs. 79.5%,  $p < 0.0001$ ), [Fig. 1B](#). Vaccination rates were slightly higher among low-income Black/African American (70.7%) and Latino (72.4%) adults, compared to low-income White (63.6%) adults, but differences were not statistically significant ( $p = 0.16$ ), [Supplemental Fig. 1](#). Low-income White adults were less likely to be vaccinated at follow-up, compared to their non-low-income counterparts (63.6% vs. 80.9%,  $p < 0.0001$ ); no meaningful differences were seen between low-income and non-low-income Black/African American (70.7% vs. 77.9%,  $p = 0.19$ ) or Latino adults (72.3% vs. 78.3%,  $p = 0.32$ ). Almost all low-income adults who were extremely willing to vaccinate at baseline were vaccinated at follow-up (93.1%), compared to 75.2% among those who were unsure and 30.2% of those not at all willing, [Fig. 2](#).

Compared to those who said they were unsure or plan to vaccinate, low-income participants who reported they would not vaccinate at follow-up were more likely to believe they did not need to be vaccinated (31.5% vs. 7.7%), and more likely to distrust the government (46.6% vs. 16.5%), drug companies (44.5% vs. 23.1%), vaccine contents (52.1% vs.



**Fig. 1.** The prevalence of A) vaccine willingness between December 2020-February 2021, and B) vaccine uptake between August-September 2021 among Black/African American, Latino, and White low-income and non-low-income adults living in the U.S. Footnote: Vaccine willingness analyses are weighted to be nationally representative within racial-ethnic groups; due to relatively low response rates, follow-up survey data is unweighted.

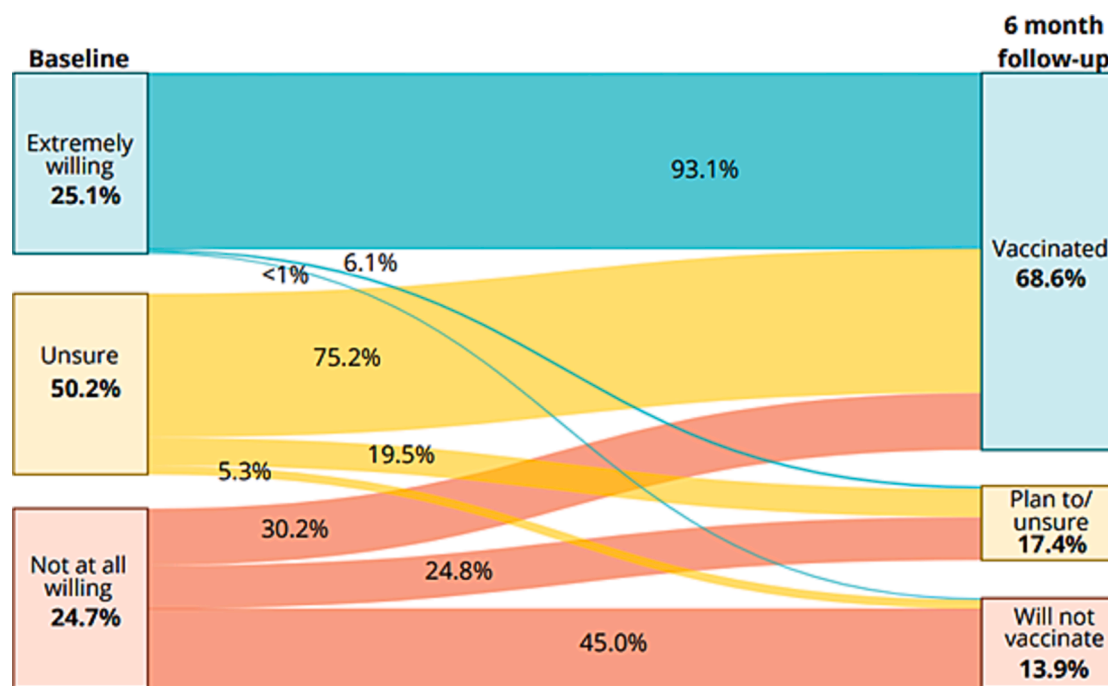


Fig. 2. Sankey plot depicting correlation between vaccine willingness and uptake among Black/African American, Latino, and White low-income adults living in the U.S. Vaccine willingness was assessed at baseline (December 2020 – February 2021) and vaccination status six months later (August – September 2021).

25.3%), and the healthcare system (24.7% vs. 9.9%),  $p < 0.05$  for all, Supplemental Fig. 2. Overall, 84.4% of low-income adults who would not vaccinate at follow-up stated that nothing would change their minds ( $n = 54/64$ ; 9 skipped the question).

#### 4. Discussion

This is the first study to investigate differences in vaccine willingness and uptake by race-ethnicity in a nationally representative sample of low-income adults. We found that among 1,500 Black/African American, Latino, and White low-income adults, only 25% were extremely willing to be vaccinated in early 2021, yet by late summer, roughly 70% of had been vaccinated. This is notably higher than the vaccination rate of 46.3% reported in April 2021 for older low-income adults in another study (Cheng and Li, 2022), highlighting how quickly vaccine rollout was performed in the United States. While no significant differences were observed between low-income and non-low-income Black/African American and Latino adults, low-income White adults were substantially less willing to be vaccinated and less likely to be vaccinated by late summer, compared to non-low-income White adults. Lower vaccination rates among low-income adults have been previously reported (Brownstein et al., 2022; Cheng and Li, 2022).

These results mirror previously published findings in our rural adult cohort (Strassle et al., 2023). Similarly to low-income White adults, rural White adults were less willing to be vaccinated and less likely to be vaccinated compared to non-rural White adults. As in this study among low-income adults, no meaningful differences in vaccination rates were observed between rural and non-rural Black/African American and Latino adults. In the United States, both rural White adults and White adults without a college education (which is correlated with lower income status) are more likely to have conservative ideologies (Pew Research Center, 2015; Parker et al., 2018), which has been shown to correlate with lower vaccine willingness for COVID-19 (Andersen et al., 2023) and other infectious diseases (Baumgaertner et al., 2018).

We also observed substantial correlation between vaccine willingness and uptake among low-income adults. Almost all (93%) of low-income adults who were extremely willing to vaccinate had received

at least one dose by follow-up. Additionally, 75% of those who were unsure and 30% of individuals who were not at all willing to be vaccinated at baseline were vaccinated at follow-up. These findings highlight that some minds were able to be changed regarding vaccination (Rane et al., 2022; Daly et al., 2021) Future research is needed to determine the relative impacts of education campaigns, work- and travel-related mandates, and observing friends and family safely receive the vaccine on uptake.

Conversely, almost half of low-income adults unwilling to vaccinate at baseline remained unwilling at follow-up, and the vast majority of unvaccinated adults stated that nothing that would change their minds about getting vaccinated. Misinformation and distrust of the government, drug companies, vaccine contents, and the healthcare system have been associated with unwillingness to vaccinate (Earnshaw et al., 2020; Loomba et al., 2021) Entrenched opinions and ideologies regarding vaccines are difficult to shift (Pertwee et al., 2022; van der Linden et al., 2021), suggesting more work is needed to combat the impact of misinformation.

Limitations of this study include that we measured self-reported vaccination status, which could be subject to social desirability bias or recall bias; however, previous studies have reported the accuracy of self-reported COVID-19 vaccination (Nguyen et al., 2022). The online recruitment method used may have excluded individuals without internet access; however, low-income adults were intentionally oversampled to produce national estimates and participants were recruited through a variety of methods. The survey was conducted in English and Spanish only. Our response rate for the follow-up survey was relatively low (34.8%); however, this is one of the first studies to survey participants on willingness and uptake prior to and after the availability of COVID-19 vaccines. Additionally, some unmeasured confounding (e.g., political ideology, profession) likely exists. Finally, our follow-up survey was conducted in August/September 2021 and trends may have changed since then.

In conclusion, this prospective study among a diverse sample of low-income adults found that low-income White adults were less willing and less likely to vaccinate than their non-low-income counterparts, but this difference was not observed for Black/African American or Latino

adults. High rates of mistrust in government and scientific institutions among unvaccinated low-income adults, especially low-income White adults, may require concentrated public health efforts to increase vaccination and restore public trust. Future research should focus on developing interventions to combat misinformation and identifying public health practices that can increase vaccine uptake for COVID-19 and future public health emergencies.

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#### Disclaimer

The opinions expressed in this article are the authors' and do not reflect the views of the National Institutes of Health, the Department of Health and Human Services, or the United States government.

#### CRedit authorship contribution statement

**Alexis L. Green:** Conceptualization, Writing – original draft, Visualization. **Anita L. Stewart:** Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Anna M. Nápoles:** Writing – review & editing. **Paula D. Strassle:** Conceptualization, Methodology, Software, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Supervision.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

Data will be made available on request.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2023.102367>.

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