# METHODS

## Measures

**Appendix Table 1.** Descriptions of Decomposition Model Variables

| Measure | Description |
|---|---|
| Vaccination | Survey question: *Have you received a COVID-19 vaccine?* |
| Intent to get vaccinated | Among those who have not yet received a vaccine, *Once a vaccine to prevent COVID-19 is available to you, would you… definitely get a vaccine, probably get a vaccine, probably NOT get a vaccine, or definitely NOT get a vaccine* |
| Demographic | |
| Race and ethnicity | Categories: non-Hispanic Black or African American alone (Black), Hispanic or Latino of any race (Hispanic), non-Hispanic Asian alone, non-Hispanic White alone, non-Hispanic persons of other or multiple races (other/multiple) |
| Age | Categories: 18–34 years, 35–49 years, 50–64 years, and ≥65 years |
| Adults in household | Number of adults in the respondent's household: 1, 2, ≥3 |
| Children in household | Number of children in the respondent's household: 0, 1, 2, ≥3 |
| Socioeconomic | |
| Income | Household income: <$25,000, $25,000–$34,999, $35,000–$49,999, $50,000–$74,999, $75,000–$99,999, $100,000–$149,999, $150,000–$199,999, and ≥$200,000 |
| Education | Categories: less than high school, some high school, high school graduate or equivalent, some college, associate degree, bachelor's degree, and graduate degree |
| Employment | Categories: government, private company, non-profit organization, self-employed, family business, unemployed, sick/disability, or retired |
| Health insurance | Whether the respondent has any form of health insurance |
| Hardship during the pandemic | |
| Trouble paying household expenses | Whether their household had difficulty paying household expenses in the past 7 days |
| Received SNAP benefits | Whether anyone in their household receives Supplemental Nutrition Assistance Program (SNAP) benefits |
| Received unemployment insurance | Whether someone in their household received unemployment insurance benefits during the pandemic |

| | |
|---|---|
| Received a stimulus check | Whether anyone in their household received an Economic Impact Payment, i.e., a stimulus check |
| Lost income during the pandemic | Whether a household lost income during the pandemic |
| Food sufficiency | Whether their household had sufficient food to eat in the past 7 days |

## Statistical Analysis

We modeled the vaccination outcomes *Y* as a function of the explanatory variables *X*:

$$Y = F(X\beta)$$

where β denotes the vector of coefficients. Because our outcome variables are binary, we choose the function *F* to be the logistic cumulative distribution function. The aggregate decomposition divides disparities between White and the comparison group into 2 terms: the part of the disparity explained by differences in covariates and the part of the disparity left unexplained by these differences. This can be written as:

$$\bar{Y}_W - \bar{Y}_C = \{\overline{F(X_W\beta_P)} - \overline{F(X_C\beta_P)}\} + \{\overline{F(X_W\beta_W)} - \overline{F(X_W\beta_C)}\}$$

where *W* indicates the White group, *C* indicates the comparison groups (Black, Hispanic, Asian, other/multiple), and $\beta_i$ indicates the coefficient estimates from a regression on the group *i* subsample. *P* here implies the estimates come from a pooled regression over all racial and ethnic groups, with group indicates included in the model.[1,2] The bar above each term indicates that these are weighted averages. The left-hand side of the equation is the actual disparity in the outcome between the 2 groups. The first term on the right-hand side is the "explained" portion of the disparity.

Detailed decomposition involves further disaggregating the explained portion of the disparity into the contribution of the individual *X* factors. The standard Oaxaca-Blinder decomposition uses linear regression, implying the functional form $F = X\beta + \epsilon$. In this case, detailed decomposition is straightforward because the linear combination of explanatory variables and coefficients can be easily rearranged. Detailed decomposition when using a logit model is more complicated because the terms are inside a non-linear function. We follow the solution proposed by Yun (2004), which suggests linearizing the effects using a first order Taylor series expansion around the functions evaluated at the means of their covariates.[3] The Oaxaca command in Stata was used to implement the decomposition analysis.[1]

The Oaxaca command uses the delta method to calculate standard errors on the decomposition terms. Replicate weights and person-level probability weights were used to account for complex survey design. Because we pooled 6 waves of the data, the replicate and probability weights were divided by 6.[4]

1. Jann B. The Blinder–Oaxaca decomposition for linear regression models. The Stata Journal. 2008;8(4):453-79.
2. Oaxaca RL, Ransom MR. On discrimination and the decomposition of wage differentials. J Econometrics. 1994;61(1):5-21.
3. Yun M-S. Decomposing differences in the first moment. Econ Letters. 2004;82(2):275-80.
4. U.S. Census Bureau. Source of the Data and Accuracy of the Estimates for the Household Pulse Survey – Phase 3 2021. https://www2.census.gov/programs-surveys/demo/technical-documentation/hhp/Phase3_Source_and_Accuracy_Week_27.pdf.

**Appendix Table 2.** Pooled Logistic Regression Results

| Variable | Vaccination coverage OR (95% CI) |
|---|---|
| Demographic variables | |
| Ages 18 to 34 years | **0.23** (0.21, 0.25) |
| Age 35 to 49 years | **0.28** (0.27, 0.30) |
| Ages 50 to 64 years | **0.36** (0.35, 0.38) |
| Ages ≥65 years | 1.00 (ref) |
| 1 Adult[a] | 1.02 (0.98, 1.07) |
| 2 Adults[a] | **1.05** (1.01, 1.08) |
| ≥3 Adults[a] | 1.00 (ref) |
| 0 Children[a] | **1.35** (1.25, 1.45) |
| 1 Child[a] | **1.24** (1.14, 1.35) |
| 2 Children[a] | **1.20** (1.11, 1.30) |
| ≥3 Children[a] | 1.00 (ref) |
| Hispanic[b] | 1.00 (ref) |
| Asian[b] | **1.21** (1.12, 1.31) |
| Black[b] | **0.87** (0.81, 0.94) |
| White[b] | **0.87** (0.82, 0.92) |
| Other/multiple[b] | 0.93 (0.83, 1.03) |
| Socioeconomic factors | |
| Health insurance | **1.56** (1.42, 1.71) |
| Income <$25,000 | **0.71** (0.65, 0.77) |
| Income $25,000–$34,999 | **0.80** (0.73, 0.86) |
| Income $35,000–$49,999 | **0.83** (0.78, 0.88) |
| Income $50,000–$74,999 | **0.89** (0.83, 0.95) |
| Income $75,000–$99,999 | **0.89** (0.84, 0.94) |
| Income $100,000–$149,999 | **0.92** (0.88, 0.97) |
| Income $150,000–$199,999 | 0.99 (0.92, 1.06) |
| Income ≥$200,000 | 1.00 (ref) |
| Education: less than high school | **0.56** (0.46, 0.68) |
| Education: some high school | **0.49** (0.43, 0.56) |
| Education: high school graduate or equivalent | **0.53** (0.50, 0.56) |
| Education: some college | **0.65** (0.62, 0.68) |
| Education: associate degree | **0.85** (0.81, 0.89) |
| Education: bachelor's degree | **0.80** (0.77, 0.82) |
| Education: graduate degree | 1.00 (ref) |
| Employment: government | **1.71** (1.61, 1.82) |
| Employment: private company | **0.87** (0.83, 0.93) |
| Employment: non-profit organization | **2.71** (2.53, 2.89) |
| Employment: self-employed | **0.78** (0.72, 0.84) |
| Employment: family business | **0.68** (0.56, 0.82) |
| Employment: unemployed | **0.62** (0.58, 0.66) |
| Employment: disabled | **0.73** (0.65, 0.82) |
| Employment: retired | 1.00 (ref) |
| Economic hardship during pandemic | |

| | |
|---|---|
| Trouble paying household expenses | **0.88** (0.84, 0.92) |
| Received SNAP benefits | **0.91** (0.84, 0.98) |
| Received unemployment insurance | 0.98 (0.93, 1.04) |
| Received a stimulus check | **0.89** (0.87, 0.92) |
| Lost income during pandemic | **0.94** (0.91, 0.97) |
| Food sufficiency | **1.21** (1.09, 1.34) |

*Note*: Boldface indicate statistical significance ($p<0.05$). Logistic regressions used person-level probability weights. CIs were calculated using replicate weights.
[a]Refers to number of adults or children in respondent's household.
[b]Racial and Ethnic groups include Hispanic or Latino (Hispanic), non-Hispanic Asian alone (Asian), non-Hispanic Black or African American alone (Black), non-Hispanic persons of other or multiple races (other/multiple), and non-Hispanic White alone (White).

SNAP, Supplemental Nutrition Assistance Program.

**Appendix**
**Racial and Ethnic Disparities in COVID-19 Vaccination Coverage: The Contribution of Socioeconomic and Demographic Factors**
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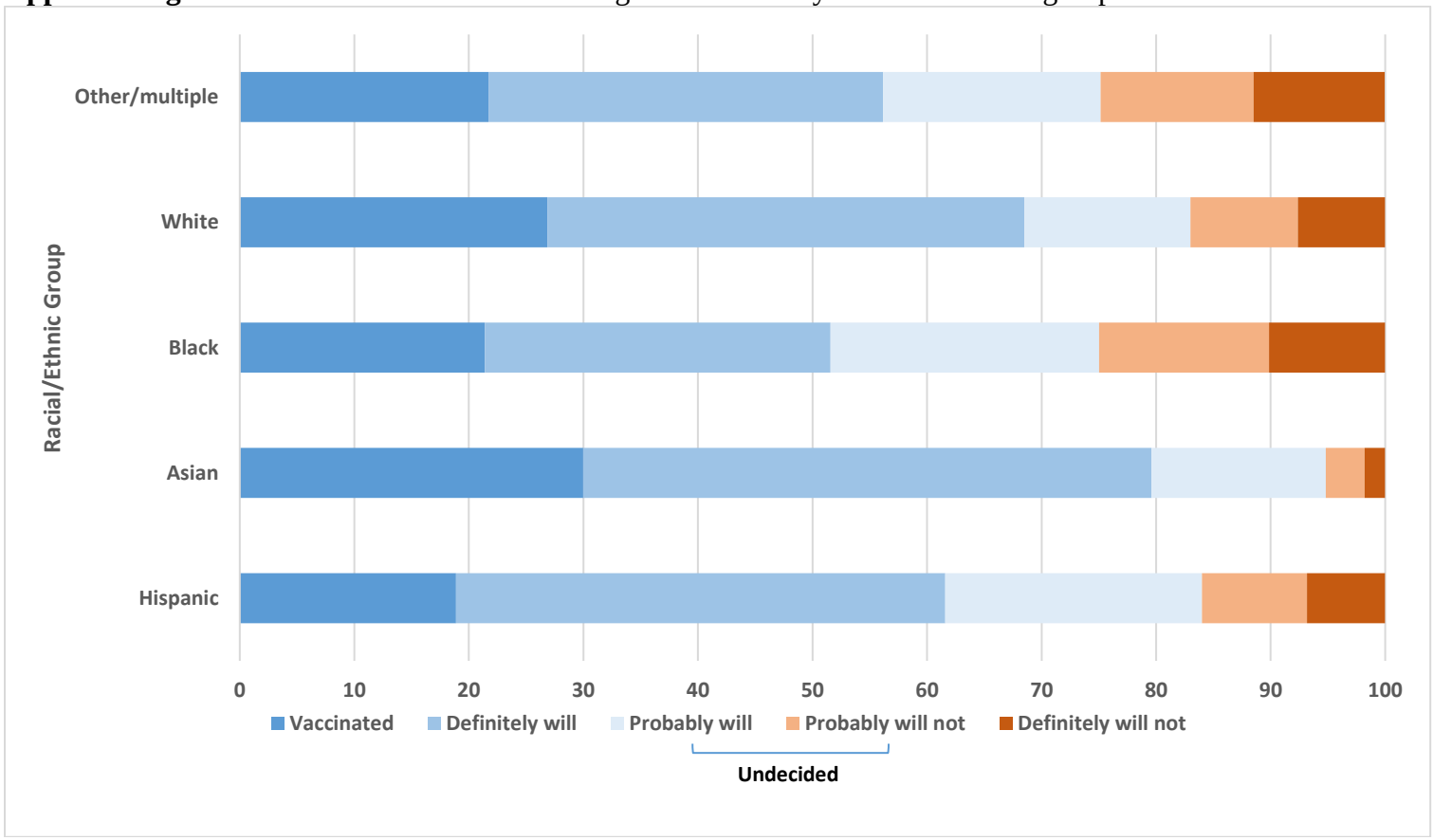
**Appendix Figure 1.** Vaccination and intention to get vaccinated by racial and ethnic group.




*Notes*: Non-Hispanic White alone is the comparison group. Racial and ethnic minority groups include Hispanic or Latino (Hispanic), non-Hispanic Asian alone (Asian), non-Hispanic Black or African American alone (Black), non-Hispanic persons of other or multiple races (other/multiple).

**Appendix Figure 2.** Racial and ethnic minority group deviations from White prevalence of reasons for not getting a COVID-19 vaccine.

| Reasons for not getting a COVID-19 Vaccine | Hispanic | Asian | Black | Other/ multiple |
|---|---|---|---|---|
| **Concerns about side effects** | 1.43 | 2.92 | **3.62** | **5.49** |
| **Not knowing if vaccine will work** | 1.02 | -0.29 | 0.81 | **4.27** |
| **Believing they do not need a vaccine** | **-8.08** | **-8.97** | **-8.86** | 1.16 |
| **Not liking vaccines** | **-1.80** | **-3.21** | -0.03 | **3.97** |
| **Doctor has not recommended** | **-1.26** | **-3.26** | 0.70 | **3.07** |
| **Plan to wait and see** | **2.91** | **8.32** | **7.55** | 2.24 |
| **Other people need it more** | **-2.39** | -0.52 | **-13.75** | -2.19 |
| **Concerns about cost** | **4.23** | **3.24** | -0.55 | **3.05** |
| **Not trusting COVID-19 vaccines** | **-4.49** | **-12.31** | **2.61** | **3.19** |
| **Not trusting the government** | **-5.12** | **-14.69** | **-2.73** | **2.81** |

*Notes*: Boldface indicate statistical significance ($p<0.05$). Weighted percentages were calculated using person-level probability weights. Non-Hispanic White alone is the comparison group. Racial and ethnic minority groups include Hispanic or Latino (Hispanic), non-Hispanic Asian alone (Asian), non-Hispanic Black or African American alone (Black), non-Hispanic persons of other or multiple races (other/multiple). Negative numbers indicate the reason for not getting a vaccine is cited less frequently in the racial/ethnic minority group than in the White group. These data were only available for the sample of respondents who said they *probably will*, *probably will not*, or *definitely will not* get a COVID-19 vaccine.

**Appendix Table 3.** Decomposition of Racial and Ethnic Disparities in COVID-19 Vaccine Coverage, Ages ≥65 Years

| Measure | NH Black[a] PP[b] (95% CI) | Hispanic PP (95% CI) | NH Asian PP (95% CI) | NH other/multiple PP (95% CI) |
|---|---|---|---|---|
| Actual disparity | **–4.25** (–6.89, –1.60) | **–4.91** (–8.24, –1.59) | **9.06** (5.47, 12.65) | **–12.54** (–17.30, –7.78) |
| Explained disparity | **–3.29** (–4.07, –2.51) | **–7.51** (–8.76, –6.26) | –0.17 (–1.37, 1.02) | **–4.66** (–6.08, –3.23) |
| Unexplained disparity | –0.96 (–3.59, 1.67) | 2.60 (–0.53, 5.73) | **9.23** (5.59, 12.88) | **–7.88** (–12.93, –2.84) |
| Detailed decomposition | | | | |
| Demographics | | | | |
| Total | **–0.45** (–0.63, –0.26) | **–0.86** (–1.21, –0.52) | –0.36 (–0.79, 0.07) | **–0.78** (–1.13, –0.43) |
| Age | 0.00 (0.00, 0.00) | 0.00 (0.00, 0.00) | 0.00 (0.00, 0.00) | 0.00 (0.00, 0.00) |
| Household size | **–0.45** (–0.63, –0.26) | **–0.86** (–1.21, –0.52) | –0.36 (–0.79, 0.07) | **–0.78** (–1.13, –0.43) |
| Socioeconomic factors | | | | |
| Total | **–1.37** (–2.06, –0.69) | **–4.72** (–5.75, –3.68) | **0.91** (0.60, 1.23) | **–2.21** (–3.70, –0.72) |
| Health insurance | –0.08 (–0.19, 0.02) | **–0.39** (–0.58, –0.21) | –0.19 (–0.48, 0.10) | **–0.18** (–0.35, –0.02) |
| Income | **–0.82** (–1.06, –0.57) | **–1.14** (–1.50, –0.78) | 0.03 (–0.18, 0.25) | **–0.49** (–0.77, –0.21) |
| Education | **–0.49** (–0.83, –0.14) | **–2.09** (–2.90, –1.29) | **1.65** (0.53, 2.76) | **–1.15** (–1.85, –0.45) |
| Employment | 0.02 (–0.38, 0.41) | **–1.09** (–1.55, –0.63) | –0.58 (–1.42, 0.27) | –0.38 (–1.90, 1.14) |
| Hardship during pandemic | | | | |
| Total | **–1.47** (–1.81, –1.13) | **–1.93** (–2.34, –1.53) | –0.73 (–1.53, 0.08) | **–1.67** (–2.15, –1.18) |

| | | | | |
|---|---|---|---|---|
| Trouble paying household expenses | **–0.71** (–0.93, –0.48) | **–0.70** (–0.93, –0.47) | –0.33 (–0.71, 0.05) | **–0.72** (–0.98, –0.45) |
| Received SNAP benefits | **–0.27** (–0.50, –0.05) | **–0.25** (–0.46, –0.03) | –0.09 (–0.24, 0.06) | **–0.27** (–0.51, –0.02) |
| Received unemployment insurance | –0.01 (–0.04, 0.02) | –0.01 (–0.06, 0.03) | –0.02 (–0.07, 0.04) | –0.01 (–0.04, 0.02) |
| Received a stimulus check | **–0.13** (–0.21, –0.04) | **–0.30** (–0.43, –0.18) | –0.13 (–0.28, 0.03) | –0.12 (–0.30, 0.06) |
| Lost income during pandemic | **–0.14** (–0.24, –0.05) | **–0.25** (–0.41, –0.09) | –0.12 (–0.27, 0.03) | **–0.29** (–0.49, –0.08) |
| Food sufficiency | **–0.20** (–0.32, –0.09) | **–0.42** (–0.64, –0.20) | –0.04 (–0.11, 0.02) | **–0.26** (–0.44, –0.08) |

*Notes*: Boldface indicate statistical significance ($p<0.05$).
[a]Racial and Ethnic groups include Hispanic or Latino (Hispanic), non-Hispanic Asian alone (Asian), non-Hispanic Black or African American alone (Black), non-Hispanic persons of other or multiple races (other/multiple), and non-Hispanic White alone (White).
[b]Percentage point (PP) difference between racial/ethnic minority group and White group. Weighted percentages were calculated using person-level probability weights. CIs were calculated using replicate weights.
Actual differences reflect the weighted difference in the outcome variable between the racial and ethnic minority group and White respondents. Explained differences are the differences predicted based on explanatory variables alone. The detailed decomposition shows how much of the explained disparity is due to each explanatory variable.

SNAP, Supplemental Nutrition Assistance Program.