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Understanding the influence of political orientation, social network, and economic recovery on COVID-19 vaccine uptake among Americans

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A B S T R A C T

The COVID-19 pandemic poses unprecedented risks to the well-being of Americans. To control the pandemic, a sufficient proportion of the population needs to be vaccinated promptly. Despite the proven efficacy and widespread availability, vaccine distribution and administration rates remain low. Thus, it is important to understand the public behavior of COVID-19 vaccination. This study aims to identify determinants at multiple levels that promote or inhibit one’s vaccine uptake. We combine individual-level data from a national survey conducted in the summer of 2021 with corresponding state-level indicators. Findings of multilevel logistic regression show that political orientation, social network, and economic recovery altogether have significant influence. We articulate that individual decision to take the vaccine are a function of their personal characteristics and are also rooted in their home state’s political, public health, and economic contexts. These findings contribute to the literature and have policy implications. Knowledge of the profiles among people who take/refuse the vaccine provides essential information to leverage certain factors and maximize vaccine uptake to mitigate the pandemic’s devastating impact.

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1. Introduction

The COVID-19 pandemic has unprecedented and widespread impacts on the population across the United States. The most recent data from Johns Hopkins University dashboard shows more than 70 million people have been infected and over 866 thousand people lost their lives by January 2022. According to the Centers for Disease Control and Prevention [1], the COVID-19 vaccines are critical to mitigate the pandemic’s devastating damage. Vaccination programs can foster individual immunity and establish herd immunity without requiring a large proportion of the population to be infected [2–3]. A Department of Health and Human Services report indicates that COVID-19 vaccinations from January until May 2021 were associated with an estimated reduction of more than a quarter million cases and nearly 39,000 deaths among Medicare beneficiaries [4]. Currently, 114 vaccines are tested in trials, and nine vaccines including the Pfizer-BioNTech and Moderna are approved for full use [5].

Despite the vaccines’ effects to protect public health and reduce the transmission of the virus, skepticism, hesitancy, and resistance remain [6–9]. Misinformation has further increased public anxieties and compromised acceptance [10]. The data shows low vaccine distribution and administration rates, which pose a major threat to controlling the pandemic and delaying the track of attaining herd immunity. The latest data shows that fully vaccinated people only account for approximately 63% of the population [11]. Against this backdrop, there is an urgent need to understand the public behavior of vaccination and identify factors leading to vaccine uptake.

Existing studies of Americans have documented stark variation in public intentions to be vaccinated against COVID-19, which is attributed to different sociodemographic characteristics including political view, age, race, and education [12–20]. Psychological traits also influence the attitudes towards the vaccine. For example, adults higher on a sense of purpose reported a greater willingness to get the vaccine [21]. The lack of trust in the vaccine approval and development processes explained most variations in vaccination likelihood [22]. Psychological traits also influence the attitudes towards the vaccine. For example, adults higher on a sense of purpose reported a greater willingness to get the vaccine [21].

Although previous research contributed to understanding public attitudes toward vaccines, several gaps remain. First, most studies used data before the vaccines were available and thus analyzed
the intention rather than the actual behavior, i.e., whether people had taken the vaccine. Second, while political orientation has been investigated using individual-level data, there is a lack of scrutiny of its effect at the collective level. Third, in addition to those factors included for inquiry, other predictors such as social network and economic recovery received less attention, and there has not been a study that analyzed these factors using measures at multiple levels. The features of a network can decide the contents of (mis) information about the vaccine. The public expects to recover from economic disruptions caused by the pandemic and to be re-employed, which at the same time might affect their perception of the virus. To complement the literature and respond to the evolving pandemic, we analyze survey data collected in the summer of 2021 and aim to understand the joint influence of political orientation, social network, and economic recovery on one’s vaccine uptake. We include measures at both the individual level and state level.

In what follows, we first explain theoretical reasons why these factors influence one’s decision to take the COVID-19 vaccine and use the rationale to develop hypotheses. Next, we introduce data from multiple sources to build measurements. We then estimate multilevel logistic regression models to test these factors’ effects empirically. The findings shed light on the underlying factors regarding why some people decide to take the vaccine (and others do not) and provide public health officials with insights to promote the vaccine targeting different populations.

2. Literature review

In this study, we analyze the influence of political orientation, social network, and economic recovery on one’s decision to take the COVID-19 vaccines. These factors have been included when investigating public risk perception of the pandemic and preventive behaviors such as mask wearing and social distancing. Building on the existing arguments, we elaborate on how these factors might also affect one’s vaccine uptake.

2.1. Political orientation

In a political climate where polarization has become the norm, trust in political leaders is connected to one’s partisan identity, and people rely on separate information sources related to their identity [30]. Regarding the pandemic, many aspects of the new virus are largely unknown, especially at the initial stages. The public has to turn to political elites (e.g., party leaders) they trust for guidance. The public reliance upon these elites to conceptualize a complicated and new issue such as a quickly evolving public health crisis grants the party leaders the power to frame the issue as they deem necessary [31]. Framing is the exercise of emphasizing certain aspects of an issue while neglecting other aspects by both the speaker (e.g., a politician) and individual members of the audience [31–32]. In a polarized political environment, the political elites frame a wide variety of issues are far apart on both sides. On the receiving end, individual members of the audience tend to favor the frame advocated by the political elites they trust. To further complicate matters, polarization drives the public trend to have greater confidence in opinions of the party leaders rather than substantive information [33].

From the outset, Democratic and Republican leaders have framed COVID-19 differently by sending contrasting messages about its severity. For example, President Biden highlighted the risk, recommended mitigation measures, and promoted the vaccine. At the same time, former President Trump downplayed the risk, rejected strategies to control the pandemic, and disseminated misinformation about the vaccine [34–35]. Meanwhile, the partisan media outlets can relay and reinforce messages from political elites in a way that influences public attitudes and behaviors regarding the pandemic, as individuals are likely to encounter politicians’ messages through the consumption of increasingly-polarized media sources [36–37].

The politically-driven rhetoric from leaders led to polarization of how the public responds to COVID-19. The confidence and favorability in political leaders can slant public response to the pandemic among people with different political orientations [38]. Americans who had more confidence in Trump’s handling of COVID-19 perceived fewer threats posed by the virus [39]. In contrast, Americans who were in favor of Biden were more likely to support COVID-19 mitigation measures such as encouraging work from home and restricting non-essential travels [40]. Recent studies of the COVID-19 vaccine find that Republicans [41], people with conservative political ideology [42–43], and those exposed to conservative media outlets [44] have greater skepticism than their counterparts.

In addition, the immediate social setting’s political context also exerts an unignorable influence on individual perceptions and behaviors [45]. Consequently, the political climate of a region where Americans reside is expected to affect their response to COVID-19. For instance, counties with high proportions of Trump voters had higher per capita cases [46]. Another study finds that people from states with unified Democratic Party controlled governments were more likely to wear a mask [47]. In comparison, people in areas with more Republicans engaged in less social distancing [48] and were less likely to comply with the stay-at-home orders [49–51].

While individual political preferences and state political institutions are different, the partisan control of the state can reflect collective public opinion to some extent. Regarding the pandemic, the state-level legislation and policies on vaccine and mask mandate are outcomes of both the party leadership and collective public opinion. Unified Democratic Party controlled states are more likely to propose COVID measures and the people are also more likely to follow the recommendations compared to Republican states. Moreover, unified Democratic control or lack of could determine whether messages and actions with regards to COVID-19 from the state government are consistent. Inconsistency can certainly lead to confusion among the public. In addition to unified Democratic party control, we include the proportion of Biden votes in the 2020 presidential election to further gauge state-level political context, as we will elaborate in the Methods section. The opinion-based Biden vote variable can complement the institutional party control variable.

2.2. Social network

The extent to which people are embedded in a social network influences their information sharing. Information that most members of the network value are more likely to be shared and upon which people base their attitudes and behaviors. Meanwhile, people who strongly identify as members of a social network are more likely to take action to protect and serve network members’ collective interests [52]. One underlying mechanism of the network effect might be the social identity that defines one’s sense of self with respect to a broader group [53]. Group membership provides self-esteem and a sense of belonging for individuals [54]. Accordingly, there is a distinct social identity between people who have taken the vaccine and those who resist the vaccine [55]. Individuals align their attitudes and behaviors with others within each group. On the one side, the people with a tendency to be vaccinated derive social benefits from the group receptive view on vaccination that in turn leads to vaccine uptake to conform to group expectation. On the other side, to maintain consensus and group
identity, the unvaccinated attach their identity to the anti-vaccine group, reinforcing the anti-vaccine sentiment such as negative views toward vaccine safety.

While one’s social network has several properties, we focus on the vaccination behavior of people in the network. Such property is directly related to individual decisions of whether to get vaccinated. A close network that exposes people to timely information on the efficacy of the COVID-19 vaccine would promote uptake. In comparison, if people are surrounded by anti-vaxxers and misinformation, they might become skeptical and resist taking the vaccine. Previous studies highlight the impact of the social network by showing that communities with close ties have fewer cases and deaths as information on the pandemic spreads and people engage in more health-protective actions [56–58]. Individual behaviors are influenced by others and the features of the network [59]. For example, one study shows that networking with neighbors, friends, and family was positively associated with the odds of wearing a mask [47]. People living in counties with extensive social networks reduced mobility faster, especially those directed at retail and recreational activities with higher COVID-19 risk [60].

2.3. Economic recovery

The economy that was damaged considerably due to the pandemic began to recover at the beginning of 2021. We have witnessed reducing unemployment rates for consecutive months. However, the connection between economic recovery and public understanding of the pandemic is in question. A previous study finds that people from states whose economies recovered closer to the pre-pandemic level in the summer of 2020 became less prone to experience threats, take precautionary measures, and support mitigation policies than people from states whose economies were still far from full recovery [61]. The authors used the back-to-normal index to measure economic recovery that captures a wide range of indicators including the labor market, housing value, investments, consumer behavior, and travel and leisure activity. They contend that the underlying reason for the finding is that a better and recovering economy might send a misleading message that the return to normalcy is on track and the COVID-19 outbreak is under control. As a result, the public could perceive it is unnecessary to continue taking those actions (e.g., wearing a mask and keeping social distance) in response to the pandemic. Following the logic, we argue that people from states whose economies have recovered (e.g., score high on the back-to-normal index) will neglect the growing cases, disregard the risk, and resist the vaccine because they misjudge the pandemic due to better economic conditions.

2.4. Hypotheses

The existing literature suggests that political orientation, social network, and economic recovery likely affect public response to the pandemic. Considering the scholarship and applying these theoretical perspectives to explain one’s vaccine uptake, we propose the following hypotheses and test the effect of these factors at both individual and state levels:

**H1a:** People who trust President Biden are more likely to take the vaccine.

**H1b:** People from Democratic Party controlled states or states with more Biden votes in the 2020 presidential election are more likely to take the vaccine.

**H2a:** People with a higher proportion of people in their social network who already took the vaccine are more likely to take the vaccine.

**H2b:** People from states with higher vaccination rates are more likely to take the vaccine.

**H3:** People from states with better economic recovery are less likely to take the vaccine.

3. Methods

We utilize data from several sources. All individual-level data, including one’s decision to take the COVID-19 vaccine, political orientation, social network, and other sociodemographic control variables, are drawn from Understanding America Study (UAS). The UAS is a longitudinal study of nationally representative samples for adults aged ≥ 18 years and managed by the Center for Economic and Social Research at the University of Southern California. The UAS, which began in 2014, recruited panel members through address-based sampling from the U.S. Postal Service Computerized Delivery Sequence file. Participants complete surveys online, and those without Internet access are provided with a tablet and broadband Internet. Surveys were administered in English and Spanish, and respondents were compensated with about $20 for each half-hour of their survey time [62].

Starting on March 10th, 2020, UAS panelists were invited to participate in an ongoing survey related to the COVID-19 pandemic. A total of 29 waves of surveys were conducted on a range of issues related to the pandemic such as risk perception, protective behaviors, perceived symptoms, and mental health [63]. For this study, we use the last wave of the survey carried out between June 9th and July 21st, 2021. The data includes approximately 6,000 respondents from all 50 states and Washington D.C.

We include state-level variables and merge those measures with individual-level data drawn from the UAS survey. The state-level indicators measure the political context (party control of the government and Biden votes in the election), the full vaccination rate of the adult population, and the level of economic recovery. We describe these variables below, and the summary statistics are reported in Table 1.

3.1. Dependent variable

One question of the survey asks respondents whether they have gotten vaccinated for the coronavirus. Answers to this question are coded in a binary way as yes (1) and no (0). On average, around 72% of respondents said yes to this question.

3.2. State-level independent variables

We adopt the party control of state government to gauge the political climate of each state and obtain the 2021 data from the National Conference of State Legislatures. The variable is measured binary, with states coded as 1 if the Democratic Party controls both chambers of Congress and the governor’s office. States are coded as 0 if the Democratic Party does not have unified control. We also use MIT’s Election Lab data to calculate the proportion of Biden votes in the 2020 presidential election. A higher proportion suggests the state has more Biden supporters and is more pro-Democratic. The variable has been transformed into the logarithmic form to correct skewness when included for regression analysis. In addition, we get the adult population’s full vaccination rates from the CDC. The rates varied during the period when the survey was conducted. We computed the mean of these daily rates and used them for analyses. Economic recovery is measured using a back-to-normal index constructed by Moody’s Analytics and CNN Business. The index represents the percentage of the economy returning to its pre-pandemic level. The index has daily indicators and we also calculated the mean based on the data when the
survey was administered. The political party control variable does not have data for Washington D.C., and the other variables are available for all 50 states and Washington D.C.

### 3.3. Individual-level independent variables

There are three variables to measure the key concepts of this study. Political orientation is gauged by the level of trust to Biden and Trump, respectively. The responses include: do not trust at all (1), trust somewhat (2), trust mostly (3), and trust completely (4). The survey does not provide information about one's political party and ideology. We acknowledge this is a limitation. Meanwhile, we contend that trust in either political leader can represent one's political identity as party loyalty exceeds substantive political views in a highly polarized environment. The social network is measured by the proportion of respondents' family or close friends who received the COVID-19 vaccine, ranging from 0% to 100%. We get the information by computing the ratio of vaccinated people out of one's total number of family and close friends. We use the logarithmic form of this variable in regression analysis.

Next, we include nine sociodemographic variables. Two questions ask whether respondents consider the COVID-19 vaccines provide important benefits to society and are useful and effective. Responses include strongly disagree (1), disagree (2), agree (3), and strongly agree (4). We compute the average to represent a positive view of the vaccine. Two other questions ask whether respondents perceive the vaccines have many known harmful side effects and may lead to illness and death. Responses also range from strongly disagree (1) to strongly agree (4), and we use the mean to represent a negative view of the vaccine. We also control for respondents’ sex (male = 1), age, race (white = 1), marital status (married = 1), household income (measured in four deciles that group annual household income from the lowest to the highest), employment status (employed = 1), and education (ranges from 1 being high school or less to 4 being a graduate degree or higher).

### 3.4. Multilevel logistic regression

We employ multilevel logistic regression with random intercepts to assess the influence of individual-level and state-level variables on one’s decision of vaccine uptake. Multilevel modeling is used because the data is hierarchical with two levels; the individual units of analysis at a lower level are nested within the state units at a higher level. We use the logistic model because the dependent variable (whether respondents take the COVID-19 vaccine) is coded in a binary way [64].

We run an unconditional multilevel model (or intercept-only model) with no predictors in the preliminary analysis. In this model, one’s decision to take the vaccine is estimated to test whether multilevel modeling is needed. We obtain the intraclass correlation (ICC), which estimates the percentage of the total variance of whether taking COVID-19 vaccine between states and is calculated by dividing the between-states variance by the total variance. The ICC statistic is 0.093, indicating that approximately 9% of the variance in the dependent variable occurs between states. The result suggests that a multilevel specification is reasonable for data analysis [65].

The regression models include several individual-level and state-level variables. We conduct regression in different models step-by-step. Model 1 includes the 12 individual-level variables and we add one state-level variable in Models 2–5 subsequently. We weight the data when performing regression analysis using the wave-specific weight variable (final_weight). The relative final post-stratification weights ensure the representativeness of the survey sample with respect to the U.S. population 18 years of age or older along several demographic dimensions. These dimensions include gender, race/ethnicity, age, education, household size, and household income as well as Census region and urban/rural characteristics of the area of residence. The models are estimated using Stata 17 and we report the odds ratio findings in Table 2.

### 4. Results

Model 1 shows that one’s political orientation and social network significantly affect their behavior of vaccination. Notably, the odds of taking the COVID-19 vaccine increase by 32.7% for a one-unit increase in the trust of President Biden. The findings support Hypothesis 1a about a positive association between vaccine uptake and the trust in Biden. In addition, People are also more likely to take the vaccine if a higher proportion of their family or close friends have already received it (odds ratio = 3.458), which supports H2a about the positive effect of the social network. For other variables, people who have a positive view of the COVID-19 vaccine are more likely to take it (odds ratio = 5.151), while
and state-level variables reveal the influence of different factors on rates and decrease with the back-to-normal index. The odds of taking the vaccine increase concomitantly with vaccination and states with more Biden votes. To further examine the effect of this variable, we include two other state-level variables in Model 4 and 5. The finding supports Hypothesis 2b by showing that the odds of people taking the COVID-19 vaccine increase by 2.6% for each percent increase in the adult population that is fully vaccinated. In comparison, the odds decrease by 3.6% for each percent increase in the back-to-normal index, which supports Hypothesis 3 about a negative association between economic recovery and vaccine uptake. We visualize the associations between the two variables in Fig. 1.

Next, we add the political party control variable in Model 2. The significant coefficient suggests that respondents from states that have unified Democratic Party controlled governments are 44.1% more likely to take the vaccine. Similarly, we include the Biden votes variable in Model 3 and we find that respondents from states with more Biden votes in the 2020 presidential election are more likely to take the vaccine (odds ratio = 2.533). Both findings support Hypothesis 1b. To further examine the effect of this variable, we use the “margins” suite of commands in Stata to visualize the association. We compute the adjusted means of the odds of taking the vaccine given different values of state government political party control and the share of Biden votes after controlling for other variables in the models. Fig. 2 provides the estimated odds including views of the vaccine, age, race, and marital status. The R-square values suggest that the state-level variables account for around 70% of the variance in personal decision to take the vaccine and individual-level variables explain nearly 50% of the variance in the dependent variable.

5. Discussion and conclusion

The COVID-19 pandemic imposes enormous morbidity and mortality burdens and disrupts societies and economies. The number of cases increased exponentially and the Summer/Fall of 2021 witnessed another surge due to the Delta variant. The emerging Omicron variant continues to speed up the transmission in the Winter and we have seen more than one million cases per day in January 2022. Meanwhile, different types of vaccines authorized for use in the U.S. have been proven safe and effective in helping prevent severe disease or death. While science informs the public that the vaccine can reshape the course of the pandemic, there are still a significant amount of Americans who are hesitant to get the vaccine. Thus, it is critical to know how to persuade a sufficient proportion of the U.S. population to take the vaccine especially now there is the newest Omicron variant threatening those with a negative view are less likely to do so (odds ratio = 0.372). Also, the odds of taking the vaccine increase by 3.7% for each year increase in age. The white is 35.6% less likely to take the vaccine than black, Asian, and others. Married people are 52.3% more likely to take the vaccine than people with other marital statuses such as separated or divorced. The impacts of gender, income, employment status, and education are statistically insignificant. The statistical significance of these individual-level variables remains in subsequent models after adding state-level variables. We display the effects of these variables in Fig. 1.

Finally, we include two other state-level variables in Model 4 and 5. The odds of taking the COVID-19 vaccine are higher in states with unified Democratic Party control and states with more Biden votes. In sum, our analyses that control for a series of individual-level and state-level variables reveal the influence of different factors on one’s decision to take the COVID-19 vaccine. Politically, people who trust Biden or reside in states with unified Democratic Party controlled governments and more Biden votes are more likely to take the vaccine (H1a and H1b). From a social network perspective, people with a higher proportion of family and friends who received the vaccine or from states with higher vaccination rates are more likely to take the vaccine (H2a and H2b). Moreover, better economic recovery at the state level inhibits vaccine uptake (H3). The decision to take the vaccine is also influenced by other factors, including views of the vaccine, age, race, and marital status. The R-square values suggest that the state-level variables account for around 70% of the variance in personal decision to take the vaccine and individual-level variables explain nearly 50% of the variance in the dependent variable.1

1 We have run multiple diagnostics to test the model fit, and the results show that we specify the models reasonably well. The AIC value is used to evaluate models in terms of their parsimony/complexity and statistical fit. The scores decrease as we include state-level measures for analyses, which suggest better fitting models. The tests for multicollinearity find no substantial problem. The details of each model including the coefficients, p-value, and 95% confidence intervals are presented in appendices.
progress made already with vaccine rollout. This study responds to the need and identifies factors that affect one’s vaccine uptake.

The regression analyses reveal the influence of factors at multiple levels. First, one’s political orientation and the political context of their home state significantly contribute to the polarization of this issue. The Biden supporters and residents of blue states have higher odds to take the vaccine than Trump supporters and residents of red states. Second, the extensive connections people possess with vaccine takers can increase their information about the vaccine’s efficacy. Together with high vaccination rates at the state
level, they all promote vaccine uptake. While we focus on testing the effect of vaccination behavior among one’s family and friends, other social network characteristics might also shape one’s decision. For example, the political partisan homophily of a network can reinforce the pattern of effects outlined when discussing the influence of political orientation. Thus, future research needs to examine different network properties’ effects when relevant measures are available. Third, economic recovery, which is the public’s common expectation, has a side effect of reducing the odds of vaccine uptake. The transition toward normalcy might create a false image that the pandemic is almost over and the vaccine has become less indispensable. Meanwhile, we acknowledge that the objective performance of the macro-economy at the state level is different from the subjective economic experience at the individual level. The economic performance indicators sometimes differ from public perceptions of how well the economy is doing. Subsequent studies can explore the association with other additional measures such as one's judgment of the macro-economy. Furthermore, people who have a positive view of the vaccine and are older, married, and non-white are more likely to take the vaccine than their counterparts.

Most previous studies have analyzed factors shaping one’s intention or acceptance of the vaccine (e.g., [12,17,25,29]). We contribute to the literature by systematically investigating multilevel determinants that promote or inhibit vaccine uptake. We articulate that individual decisions to take the vaccine are a function of their personal characteristics and are also rooted in their home state’s political, public health, and economic contexts. From a methodological perspective, our research demonstrates the value of analyzing one's vaccine uptake compared to evaluating the willingness to take the vaccine, which might not accurately gauge one’s authentic attitude towards the vaccine. In addition, it is critical to include measures of the same predictor at multiple levels as people’s vaccine uptake is importantly related to a multitude of variables that exist at personal, local and overarching, state levels. Similar findings regarding multilevel measures of the same concept can reinforce the hypothesized relationship than counting on conclusions of the one-level analysis.

The successful control of this unprecedented public health crisis relies on the extent to which people are vaccinated promptly. Knowledge of the profiles among people who have taken/refused the vaccine provides essential information to leverage the relevant factors and maximize vaccine uptake. According to our findings, the public health officials and locally trusted leaders need to work collaboratively to de-politicize the arguments surrounding the vaccine. They need to highlight a common identity that all Americans share when facing the same virus and bipartisan support is necessary for locating effective solutions. Their endorsement of the vaccine may be helpful. This concerted endeavor is multifactorial that must be addressed simultaneously at national, state, and county levels. In addition, encouraging vaccine takers to recommend vaccines to their family, friends, colleagues, and neighbors is also effective. A social network that delivers accurate information about the vaccine’s benefits, especially targeting the younger, less-educated, and those who have a skeptical view about the vaccine, can be critical to securing this group's commitment to vaccination and establishing a national inoculation program. Meanwhile, it is imperative to alert residents from states with a better economic recovery that the pandemic remains severe and deadly, which will disrupt the trajectory if we cannot achieve a sufficient vaccination rate.

Overall, this study provides evidence regarding the public behavior in taking the COVID-19 vaccine. There are limitations and research on vaccine uptake call for more studies. First, we analyze the latest wave of the UAS survey conducted in the past summer. With the ups and downs of confirmed cases, emerging variants, and more information around different kinds of vaccines, public behavior will likely be affected. Thus, future studies should continue monitoring the trend using more recent data or panel data if available. Additional studies might also focus on the booster uptake since vaccine efficacy wanes over time and the booster has become increasingly necessary [66]. Second, in addition to the
three factors included in the present study, scholars might consider other factors (e.g., personal experience with the virus and government mandate) that might also shape one's decision to take the vaccine and change the mindsets of anti-vaxxers. Third, our individual-level political orientation measure is trust in Biden or Trump. Constrained by the data availability, we did not use formal measures of partisanship (Democrat, Independent, and Republican) and political ideology (liberal, moderate, and conservative). While we contend that trust in either political leader overlaps with one's partisan identity in a highly polarized environment, it would be ideal to include both formal measures in future studies.

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Appendix

Appendix 1. Multilevel Logistic Regression Results for Model 1

|                          | OddsRatio | p-value | 95% Confidence Intervals |
|--------------------------|-----------|---------|--------------------------|
| Trust Biden              | 1.327     | 0.002   | 1.105 1.595              |
| Trust Trump              | 0.888     | 0.113   | 0.767 1.029              |
| Proportion of Family or Close Friends Vaccinated (ln) | 3.458 | 0.000 | 2.588 4.622 |
| Positive View of COVID-19 Vaccine | 5.151 | 0.000 | 3.931 6.750 |
| Negative View of COVID-19 Vaccine | 0.372 | 0.000 | 0.302 0.458 |
| Male                     | 0.791     | 0.089   | 0.603 1.037              |
| Age                      | 1.037     | 0.000   | 1.029 1.045              |
| White                    | 0.644     | 0.008   | 0.467 0.889              |
| Married                  | 1.523     | 0.001   | 1.188 1.952              |
| Income                   | 1.122     | 0.075   | 0.988 1.273              |
| Employed                 | 1.267     | 0.202   | 0.881 1.820              |
| Education                | 1.095     | 0.192   | 0.955 1.255              |

Appendix 2. Multilevel Logistic Regression Results for Model 2

|                          | OddsRatio | p-value | 95% Confidence Intervals |
|--------------------------|-----------|---------|--------------------------|
| Trust Biden              | 1.330     | 0.002   | 1.107 1.599              |
| Trust Trump              | 0.890     | 0.121   | 0.769 1.031              |
| Proportion of Family or Close Friends Vaccinated (ln) | 3.438 | 0.000 | 2.574 4.594 |
| Positive View of COVID-19 Vaccine | 5.133 | 0.000 | 3.911 6.738 |
| Negative View of COVID-19 Vaccine | 0.373 | 0.000 | 0.302 0.460 |
| Male                     | 0.796     | 0.098   | 0.607 1.043              |
| Age                      | 1.037     | 0.000   | 1.029 1.045              |
| White                    | 0.645     | 0.008   | 0.467 0.891              |
| Married                  | 1.533     | 0.001   | 1.197 1.961              |
| Income                   | 1.118     | 0.087   | 0.984 1.270              |
| Employed                 | 1.271     | 0.197   | 0.883 1.829              |
| Education                | 1.089     | 0.217   | 0.951 1.247              |
| Democratic Party Control of Government | 1.441 | 0.047 | 1.005 2.065 |

Authors' Note

F.H. conceptualized the study and performed statistical analyses. F.H. and W.S. wrote the manuscript. All authors approve of the final version of the manuscript.

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.

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### Appendix 3. Multilevel Logistic Regression Results for Model 3

|                       | Odds Ratio | p-value | 95% Confidence Intervals |
|-----------------------|------------|---------|-------------------------|
| Trust Biden           | 1.324      | 0.003   | 1.101 - 1.592           |
| Trust Trump           | 0.892      | 0.127   | 0.770 - 1.033           |
| Proportion of Family or Close Friends Vaccinated (ln) | 3.430 | 0.000  | 2.568 - 4.582          |
| Positive View of COVID-19 Vaccine | 5.173 | 0.000  | 3.937 - 6.796          |
| Negative View of COVID-19 Vaccine | 0.373 | 0.000  | 0.303 - 0.460           |
| Male                  | 0.788      | 0.086   | 0.600 - 1.034           |
| Age                   | 1.037      | 0.000   | 1.029 - 1.045           |
| White                 | 0.644      | 0.007   | 0.467 - 0.889           |
| Married               | 1.543      | 0.001   | 1.205 - 1.975           |
| Income                | 1.114      | 0.098   | 0.981 - 1.265           |
| Employed              | 1.267      | 0.200   | 0.882 - 1.820           |
| Education             | 1.093      | 0.203   | 0.953 - 1.253           |
| Biden Votes in the 2020 Presidential Election (ln) | 2.533 | 0.020  | 1.157 - 5.544          |

### Appendix 4. Multilevel Logistic Regression Results for Model 4

|                       | Odds Ratio | p-value | 95% Confidence Intervals |
|-----------------------|------------|---------|-------------------------|
| Trust Biden           | 1.328      | 0.003   | 1.105 - 1.597           |
| Trust Trump           | 0.892      | 0.126   | 0.770 - 1.033           |
| Proportion of Family or Close Friends Vaccinated (ln) | 3.429 | 0.000  | 2.569 - 4.576          |
| Positive View of COVID-19 Vaccine | 5.125 | 0.000  | 3.905 - 6.726          |
| Negative View of COVID-19 Vaccine | 0.375 | 0.000  | 0.304 - 0.462           |
| Male                  | 0.788      | 0.084   | 0.601 - 1.032           |
| Age                   | 1.037      | 0.000   | 1.029 - 1.045           |
| White                 | 0.633      | 0.005   | 0.459 - 0.874           |
| Married               | 1.537      | 0.001   | 1.200 - 1.969           |
| Income                | 1.110      | 0.109   | 0.977 - 1.261           |
| Employed              | 1.259      | 0.211   | 0.877 - 1.808           |
| Education             | 1.096      | 0.186   | 0.957 - 1.257           |
| People 18 + who are Fully Vaccinated | 1.026 | 0.024  | 1.003 - 1.050          |

### Appendix 5. Multilevel Logistic Regression Results for Model 5

|                       | Odds Ratio | p-value | 95% Confidence Intervals |
|-----------------------|------------|---------|-------------------------|
| Trust Biden           | 1.324      | 0.003   | 1.101 - 1.592           |
| Trust Trump           | 0.890      | 0.119   | 0.769 - 1.030           |
| Proportion of Family or Close Friends Vaccinated (ln) | 3.428 | 0.000  | 2.565 - 4.581          |
| Positive View of COVID-19 Vaccine | 5.175 | 0.000  | 3.947 - 6.784          |
| Negative View of COVID-19 Vaccine | 0.373 | 0.000  | 0.303 - 0.459           |
| Male                  | 0.791      | 0.088   | 0.604 - 1.035           |
| Age                   | 1.037      | 0.000   | 1.029 - 1.045           |
| White                 | 0.651      | 0.009   | 0.471 - 0.899           |
| Married               | 1.537      | 0.001   | 1.198 - 1.971           |
| Income                | 1.118      | 0.082   | 0.986 - 1.268           |
| Employed              | 1.271      | 0.197   | 0.883 - 1.829           |
| Education             | 1.092      | 0.206   | 0.953 - 1.252           |
| Back-to-Normal Index  | 0.964      | 0.022   | 0.934 - 0.995           |
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