Can targeted messages reduce COVID-19 vaccination hesitancy? A randomized trial

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ABSTRACT

Background: Widespread vaccination is certainly a critical element in successfully fighting the COVID-19 pandemic. We apply theories of social identity to design targeted messaging to reduce vaccine hesitancy among groups with low vaccine uptake, such as African Americans and political conservatives.

Methods: Participants. We conducted an online experiment from April 7 to 27, 2021, that oversampled Black, Latinx, conservative, and religious U.S. residents. We first solicited the vaccination status of over 10,000 individuals. Of the 4,609 individuals who reported being unvaccinated, 4,190 enrolled in our covariate-adaptive randomized trial.

Interventions. We provided participants messages that presented the health risks of COVID-19 to oneself and others; they also received messages about the benefits of a COVID-19 vaccine and an endorsement by a celebrity. Messages were randomly tailored to each participant’s identities—Black, Latinx, conservative, religious, or being a parent.

Outcomes. Respondents reported their intent to obtain the vaccine for oneself and, if a parent, for one’s child.

Results: We report results for the 2,621 unvaccinated respondents who passed an incentivized manipulation check. We find no support for the hypothesis that customized messages or endorsers reduce vaccine hesitancy among our segments. A post hoc analysis finds evidence that a vaccine endorsement from Dr. Fauci reduces stated intent to vaccinate among conservatives.

Conclusions: We find no evidence that tailoring public-health communication regarding COVID-19 vaccination for broad demographic groups would increase its effectiveness. We recommend further research on communicators and endorsers, as well as incentives.

1. Introduction

Vaccine hesitancy has prolonged the COVID-19 pandemic in the U.S. Overcoming vaccine hesitancy is complicated because the reasons for resisting vaccination can be demographic-specific. For example, hesitancy regarding COVID-19 vaccination is higher among political conservatives and African Americans; some surveys also find increased hesitancy among Latinx people, religious Christians, and parents (Latkin et al., 2021; Milligan et al., 2021; Khubchandani and Macias, 2021; Momplaisir et al., 2021a, b; Tram et al., 2021; Riad et al., 2021a).

We apply theories of social identity to design messaging to reduce vaccine hesitancy among specific population segments. We test whether respondents report greater intent to take a hypothetical vaccine after receiving messages targeted to their demographic segment.

1.1. Studies on vaccine hesitancy

Dubé et al. (2015) and Aw et al. (2021) nicely summarize the literature on vaccine hesitancy. Here we discuss factors emphasized in the standard model and in theories referencing one’s sense of identity.

Prior research on health decisions often uses a rational costs-benefits framework (e.g., Strecher and Rosenstock, 1997; Armitage and Conner, 2001; on COVID-19 specifically, Kreps et al., 2020; Riad et al., 2021b). These approaches highlight:
Identity can also affect preferences:
- One concerned about status within a group may follow the advice or actions of high-status people in the group.
- People may follow their perceptions of typical group behavior (“descriptive norms”) or of what the group considers proper behavior (“prescriptive norms”).
- If people internalize group norms, they may follow high-status leaders or their perception of common activities, as either can signal the relevant group norms.

1.3. Hypotheses

An individual may possess multiple identities—Black or African American, Hispanic or Latina/o/x, religiously observant (prior weekly participation), politically conservative, and an active parent. Consider non-targeted messages that promote COVID-19 vaccination and messages tailored to these specific segments of the population.

Targeted messages may heighten attention to (or the salience of) aspects of the vaccination decision of particular importance to the individual. Religious individuals may focus on the possibility of the return of church services. Black or Latinx individuals may focus on the pandemic’s disproportionate impact on their own community.

Relative to generic messages, targeted messages may also carry additional information. Individuals may learn that vaccine trials include genetic diversity. The informational content of an endorsement from someone with shared identity may be more trustworthy. An endorsement from a high-status group member may also convey group norms.

An individual who is a member of any of our five segments of interest may receive treatment of identity-targeted messages that promote COVID-19 vaccination. We hypothesize that the average marginal effect of an additional identity-concordant message has a positive effect on an individual’s intent to vaccinate. We further hypothesize that, among conservatives, an endorsement from Donald Trump is more effective than alternatives.

2. Methods

We conduct a randomized trial with online survey respondents. Following instructions and consent, we survey demographics, ask each respondent to read ten messages carefully to answer an incentivized question regarding message content, and finally elicit vaccination intention. The messages are randomly tailored to each respondent’s segments.

For example, a Black respondent might receive a control message with a photo of Dr. Anthony Fauci (who is white), or a targeted message with a photo of COVID-19 vaccine co-developer Kizzy Corbett (who is Black). The text might refer to the average risk of COVID-19, or it might emphasize that African Americans are more likely to suffer from COVID-19.

2.1. Messages

Our baseline messages emphasize the health risks of COVID-19 and the safety and benefits of a hypothetical COVID-19 vaccine (Table 1). We randomized message components for specific segments (Appendix A). For respondents eligible for more than one message, we randomized the several message components with equal probability, balanced on segments. Nearly all messages were accompanied by photos. Importantly, either all possible treatments for a given component had corresponding photos or none did.

2.1.1. Danger of COVID-19

All respondents read, “COVID-19 has infected over 30 million Americans, leading to over 500,000 deaths.” A random subset of Black and Latinx respondents also read about the higher impact on their
community. A separate randomization of the religiously observant read that the virus has spread frequently in their place of worship (church, synagogue, mosque, or temple, each with an appropriate photo).

2.1.2. Vaccine safety
All respondents read, “The vaccine has been approved by a rigorous FDA process involving tens of thousands of people. This randomized trial found very high effectiveness and almost no serious side effects.” African Americans and Latinx people were randomized to also read that the trial included people from their group. Fig. 1 depicts examples.

2.1.3. Parenting
Parents randomly received, “Children are at risk of long-term damage to their lungs and other organs. Nobody is sure how common or long-lasting this damage will be.” A photo of children was included; Latinx parents saw children in a Hispanic parade.

2.1.4. Spillovers to the community
Infectious diseases have large negative externalities in communities. Thus, concern for others can be a major predictor of willingness to vaccinate. Everyone received, “The elderly are most at risk for COVID-19. Unfortunately, some cannot be vaccinated because of health conditions.”

This was followed with a randomized control message, “We must protect our elders and get vaccinated!” Parents randomly received this instead: “Imagine what you would feel like if you did not vaccinate your child, and then an elderly person in your home became ill.” This included a photo of two grandparents playing with grandchildren. Conservatives randomly received this instead: “We share small-town values like caring for our neighbors—especially elders.” Finally, a subset of religious respondents read this: “The Bible tells [Our holy books tell] us to care for those most vulnerable.”

Finally, everyone received the message, “When you get vaccinated, you help protect yourself and the people around you from this virus.”

2.1.5. Benefits: Ending social isolation
Our control condition explains, “You can make up for missed get-togethers with friends and family once everyone has been vaccinated.” Latinx respondents randomly received an accompanying photo of a quinceañera, celebrating the fifteenth birthday of a young Latina (see Fig. 2). Parents randomly received, “You can make up for missed children’s parties and outings with friends and family once everyone has been vaccinated,” alongside a photo of a children’s party. Religious respondents randomly received, “You can safely attend [place of worship] with friends and family once everyone has been vaccinated,” with a photo of the respective place of worship. All respondents then received, “These events will be so much nicer when they are safe.”

In an additional randomization, some religious conservatives received, “Freedom to go to church is the freedom to worship together, not infect each other!”

2.1.6. Availability
Respondents received a control message: “The vaccine is available at your doctor’s office and local pharmacies.”

Some religious and parents also read that the vaccine is available at their place of worship or their child’s school. These locations increase convenience, imply an endorsement by their religious group or school, and suggest that vaccines are normative for that group.
2.1.7. Language
Latinx respondents were randomly treated with Spanish parallel text for all messages received.

2.1.8. Other messages components
We additionally randomized the following treatments:

- Conservatives randomly received, “When you get vaccinated, you help protect your body and your mind from this nasty and foreign virus.”
- Non-Black, non-Latinx conservatives randomly received, “Republican governors from Georgia to Ohio have stressed the economic and human cost of this pandemic.”

2.1.9. Recommendations
Each respondent received an endorsement by a famous person such as Dr. Fauci, Donald Trump, Barack and Michelle Obama, a famous religious leader (e.g., the Pope), or a famous entertainer or athlete (e.g., Tom Hanks, LeBron James). Fig. 3 depicts example recommendations. Some endorsers were selected to be concordant on conservatism (e.g., Trump vs. the Obamas), identifying as Latinx (e.g., Hanks vs. Jennifer Lopez), identifying as Black, or religious affiliation (Appendix Table 6).

We chose our recommenders from lists of celebrities from each segment, identifying those with a large social media presence or those recommended by consultants or pilot-survey respondents.

We gave each participant a set of messages they might receive, based on their personal characteristics. We then randomized messages. The risk sets for all respondents included a recommendation by Dr. Fauci. We included Trump and the Obamas if not a Black conservative, and Dwayne Johnson if not Latinx and age 65 or older.

The risk set for all religious respondents included a religious leader: If Black, the Reverend Warnock, a famous Black pastor and current U.S. senator. For others the endorsement came from the Pope (if Catholic or Latinx) or Rick Warren (if non-Black, non-Latinx, non-Catholic), founder of the Saddleback evangelical megachurch.

If Black, the risk sets included LeBron James or Kizzy Corbett.

If Latinx, the risk set included Alejandro Fernández (for ages over 65), Jennifer Lopez (if religious and under 65), or Bad Bunny (if non-religious and under 65). If Latinx and over 65, the risk set also included Tom Hanks and the Pope.

If neither Black nor Latinx but conservative, the set included Tom Brady. If not both religious and conservative, Tom Hanks. If neither conservative nor religious, LeBron James.

2.1.10. Pre-testing messages
We qualitatively tested messages with experts on each segment. We addressed both comprehension and suitability. We then conducted a quantitative pilot where respondents rated different messages.

2.2. The sample
We recruited United States residents through Prolific, which maintains a participant pool for web-based research and facilitates sampling stratified on participant characteristics.

We over-sampled individuals who had told Prolific they (1) identify as Black or African American, (2) identify as Latina/o/x or Hispanic, (3) either voted for Trump in 2020 or self-reported being “conservative” on a political spectrum, or (4) reported at least weekly participation in religious activities pre-pandemic. The screening questions are in Appendix E.

In April 2021, we invited participants who met our selection criteria to take an initial single-question screening survey: “Have you already taken a COVID-19 vaccine dose?”. Appendix Table 8 describes respondent demographics.

We restrict our analysis to those without any COVID-19 vaccination who correctly answered an incentivized attention check. At that time, roughly half of American adults had received at least one vaccine dose. Appendix B contains details and a sampling pipeline diagram. We stopped recruiting for the study once enrollment plateaued (Fig. 6).

Appendix F describes consent, instructions, the manipulation check, and debriefing.

2.3. Outcome measures
Our primary outcome is the reply to: “How likely are you to take the COVID-19 vaccine described above?” Possible responses ranged from “highly unlikely” (coded as 1) to “highly likely” (7). We drop respondents who chose “Don’t know/ prefer not to say” (N = 50, 1%). Parents also answered a similar question about vaccinating their child.

2.4. Statistical methods
We had intended to enroll 6,500 to 7,000 participants (at least 1,000 per segment). Similar studies (c.f., Freeman et al., 2021; Kreps et al., 2020) have found effects with comparable sample sizes. We were ultimately constrained by the relatively small size of the Prolific participant pool. Attrition during the sampling procedure was minimal (Appendix B).

We implement covariate-adaptive stratified block randomization given our five segments of interest, obtaining 32 strata (“subsegments”). Participants are at risk for multiple randomized treatment components given their subsegment membership. Each possible treatment is assigned with equal probability by Qualtrics survey software, maintaining balance.

Our main test examines willingness to be vaccinated depending on

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1 The UCSB Human Subjects Committee exempted our Protocol 60-20-0658.
(a) A baseline endorsement with Spanish parallel text treatment. Photo credit: NIAID.

Dr. Fauci

"I have been waiting for this vaccine!
I encourage everyone to get vaccinated as soon as possible!"

"¡He estado esperando a que llegara esta vacuna!
¡Recomiendo que todas y todos se vacunen lo antes posible!"

(b) A possible endorsement treatment for the Black segment. Photo credit: Kizzmekia Corbett.

Dr. Kizzy Corbett

Lead Developer of the COVID vaccine at the National Institutes of Health

"I could never sleep at night if I developed anything – if any product of my science came out – and it did not equally benefit the people that look like me. Period."

(c) A possible endorsement treatment for most participants. Photo credit: Michael Vadon.

Donald J. Trump

"I would recommend the vaccine to everyone, especially people who voted for me and are reluctant.
It’s a safe vaccine and it’s something that works."

Fig. 3. Example endorsements.
the number of concordant messages. We include separate intercepts for each subsegment, controlling for the respondent’s maximal possible intensity of treatment. Student’s t-test is then an exact test with the inclusion of subsegment fixed effects (Bugni et al., 2018). We drop subsegments with fewer than ten respondents (six subsegments, N = 17).

We next estimate which message components matter. To reduce the number of tests, we consider bundles of message components—“Population tested in the trials,” “Community impact,” “Children affected,” “Protecting the elderly,” “Protection,” “Elders,” “Gatherings,” and “Availability.”

We test the joint effect of all concordant messages received by each segment: Black or African American, Latinx or Hispanic, conservative, religious, and parents.

Last, our analysis plan pre-specified a test of whether Trump is a particularly effective endorser among conservative respondents.

3. Results

3.1. Descriptive analysis

Table 2 displays summary statistics: 46% were “highly likely” and 15% were “highly unlikely” to get vaccinated, with other replies scattered (Fig. 4). Intention-to-vaccinate children (mean 4.16, range 1 to 7) was lower than intention-to-vaccinate self (4.63).

Latinx individuals were relatively high (5.47), but Black individuals (5.00), the religious (4.89), and parents (4.63) showed lower willingness. Conservatives were the negative outlier (3.66). A full third (33%) of conservatives reported they were “highly unlikely” to accept the vaccine, more than twice the average. Those not in any segment had the mean intention-to-vaccinate of 6.29, higher than the focal segments.

3.2. Do concordant messages increase likelihood to vaccinate?

Our sample for the experiment included 2,621 respondents who were members of at least one segment (mean membership of 1.62 segments). The mean number of identity-tailored messages possible for a participant was 5.16. Fig. 5 shows histograms of treatment intensity; Appendix C offers additional tabulations.

Table 3 contains our primary results. Our analysis uses ordered-logit specifications (similar results using ordinary least squares available upon request). We find no evidence of a relationship between the number of concordant messages received and reporting a greater intention-to-vaccinate. Results for parents’ intention-to-vaccinate child are similar in having a positive sign, a small magnitude, and lack of statistical significance.

We then tested which message components matter: if the vaccine was tested on a population including one’s own group (pooling Black and Latinx segments); if the gatherings enabled by the vaccine are highly relevant to your group (pooling Latinx, conservative, religious and parent segments); “Impact” messages (including Church impacts); “Elders” messages; “Protection” messages; “Gatherings” messages; and “Availability” messages (Appendix Table 11). Consistent with Table 3, the coefficients are collectively not statistically significant ($\chi^2 = 5.39, p = 0.715$).

We next tested if concordant messages might matter for a specific segment (Appendix Table 12). There is no evidence that having concordant messages is statistically significantly useful for any of our five segments ($\chi^2 = 1.54, p = 0.908$).

3.3. Does Trump matter specifically for conservatives?

Conservatives are the most vaccine-hesitant group. We pre-specified one celebrity endorsement as most important—the effect of Trump, who at times recommended vaccination. To reduce the number of subsegments and comparison recommenders, we focus on non-Black, non-Latinx conservatives. Results, with Trump as the baseline recommender, are shown in Table 4.

Conservatives are almost equally responsive to the Obamas ($\beta = -0.003$, 95% CI = [−0.392, 0.387], $p = 0.99$) and not detectably less responsive to Tom Brady (a prominent conservative, $\beta = -0.044$, 95% CI = [−0.449, 0.362], $p = 0.833$), both relative to Trump.

The other possible recommenders were slightly less effective than Trump. The joint test shows Trump is distinct on average from the seven segment (Appendix Table 12).

Table 2 Summary statistics.

| Segment | N     | Mean intent | Prob. equals no segments | % Highly unlikely |
|---------|-------|-------------|--------------------------|-------------------|
| Black   | 675   | 5.00 (2.25) | 0.00                     | 17%               |
| Latinx  | 602   | 5.47 (2.03) | 0.00                     | 10%               |
| Conservative | 1174  | 3.66 (2.38) | 0.00                     | 33%               |
| Religious | 719   | 4.89 (2.31) | 0.00                     | 18%               |
| Parent  | 1093  | 4.63 (2.44) | 0.00                     | 23%               |

Overall | 3668  | 5.18 (2.26) | 0.00                     | 15%               |

A member of ≥1 segment | 2638  | 4.75 (2.36) | 0.00                     | 20%               |

A member of no segments | 1030  | 6.29 (1.48) | 0.00                     | 4%                |

| Intent to vaccinate child* | N     | Mean intent | Prob. equals no segments | % Highly unlikely |
|---------------------------|-------|-------------|--------------------------|-------------------|
| Black                     | 221   | 4.65 (2.38) | 0.04                     | 22%               |
| Latinx                    | 103   | 4.72 (2.28) | 0.15                     | 18%               |
| Conservative              | 449   | 2.97 (2.30) | 0.00                     | 48%               |
| Religious                 | 332   | 4.31 (2.48) | 0.00                     | 28%               |
| Parent                    | 244   | 5.10 (2.23) | 0.00                     | 16%               |

Overall | 1032  | 4.16 (2.48) | 0.00                     | 30%               |

A member of ≥1 segment | 788   | 3.87 (2.47) | 0.00                     | 34%               |

A member of no segments | 244   | 5.10 (2.23) | 0.00                     | 16%               |

* For intent to vaccinate child, the sample is restricted to parents; accordingly “a member of ≥1 segment” considers only the non-parent segments, as does “a member of no segments.”

Notes: Standard deviations in parentheses. Intent of 1 corresponds to “highly unlikely” to vaccinate, while 7 is “highly likely.” We intentionally over-sampled our demographics of interest, so our sample is not representative, and the means above are unweighted. Many respondents are in more than one segment (e.g., Latinx and Religious and Parent). Because respondents in different segments received different combinations of message elements, the means are not directly comparable. This table uses the sample for descriptive statistics (see Appendix Fig. 7 for the sampling flowchart).

2 We pre-registered our study with the American Economic Association as AEARCTR-0007478 (Reddinger et al., 2021). We use Stata 17 and R 4.0.2 for analysis. Reddinger et al. (2022) provide data and source code.
Fig. 4. Distribution of likelihood to accept the vaccine described.
Fig. 5. Sample characteristics: segment membership and concordant messages.
### Table 3
Does receipt of concordant messages increase willingness to vaccinate?

#### Panel A. Effect of concordant score on intent to vaccinate

| Concordant score | Intent to vaccinate self | Intent to vaccinate child |
|------------------|--------------------------|---------------------------|
|                  |                          |                           |
| Cut 1            | −0.305                   | −0.095                    | 0.786                      |
|                  | [−0.605, −0.195]         | [−0.55, −0.605]           | [−0.43, 0.085]             |
| Cut 2            | 0.044                    | 0.563                     | 0.45                       |
|                  | [0.013, 0.075]           | [0.5, 0.6]                | [0.42, 0.48]               |
| Cut 3            | −0.049                   | −0.107                    | 0.688                      |
|                  | [−0.183, −0.003]         | [−0.12, −0.09]            | [−0.62, 0.12]              |
| Cut 4            | −0.049                   | −0.107                    | 0.688                      |
|                  | [−0.183, −0.003]         | [−0.12, −0.09]            | [−0.62, 0.12]              |
| Cut 5            | 0.044                    | 0.563                     | 0.45                       |
|                  | [0.013, 0.075]           | [0.5, 0.6]                | [0.42, 0.48]               |
| Cut 6            | −0.049                   | −0.107                    | 0.688                      |
|                  | [−0.183, −0.003]         | [−0.12, −0.09]            | [−0.62, 0.12]              |
| Subsegments      |                          |                           |
|                  | 24                       | 11                        |
| Observations     | 2621                     | 1032                      |

Notes: 95% confidence intervals in brackets using heteroskedasticity-robust standard errors. Each regression includes subsegment fixed effects. Outcome ranges from 1 (highly unlikely) to 7 (highly likely). Concordant score is the number of message attributes customized for that respondent’s segment memberships, plus an additional unit if treated with Spanish parallel text if Latinx. *p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001.

#### Panel B. Margins of coefficient on concordant score

| N   | 1     | 2     | 3     | 4     | 5     | 6     | 7     |
|-----|-------|-------|-------|-------|-------|-------|-------|
| Self| 2621  | −0.0026| −0.0005| −0.0002| −0.0003| −0.0002| 0.0002| 0.0035|
| Child|1032   | −0.0058| −0.0005| −0.0002| −0.0003| 0.0001| 0.0008| 0.0057|

Notes: The marginal change in the likelihood of reporting the given category of vaccination intent due to an increase of one concordant element, based on the ordinal logit estimates in Panel A.

### Table 4
Comparison of recommendations among conservatives.

|                | Ordered logit | (Reference recommender: Donald Trump) |
|----------------|--------------|---------------------------------------|
|                | Intent to vaccinate self | Intent to vaccinate child |
| The Obamas     | −0.003       | 0.281                                 |
|                | [−0.292, 0.287] | [−0.423, 0.985]                       |
| Dr. Fauci      | −0.618**     | −0.136                                |
|                | [−1.012, −0.223] | [−0.847, 0.576]                       |
| Dwayne “The Rock” Johnson | −0.305 | −0.107                                |
|                | [−0.695, −0.086] | [−0.890, 0.676]                       |
| Tom Brady      | −0.044       | 0.563                                 |
|                | [−0.449, −0.362] | [−1.161, 1.288]                       |
| Tom Hanks      | −0.332       | 0.241                                 |
|                | [−0.752, −0.089] | [−0.618, 1.100]                       |
| The Pope†      | −1.104*      | 0.45                                 |
|                | [−1.969, −0.239] | [−1.104, 0.45]                       |
| Rick Warren    | −0.208       | 0.285                                 |
|                | [−0.786, −0.369] | [−0.577, 1.147]                       |
| P(all other recommenders = Trump) | 0.007** | 0.347                                |
| Recommender risk-sets‡ | 4     | 2                                     |
| Observations   | 963          | 381                                   |

Notes: 95% confidence intervals in brackets using heteroskedasticity-robust standard errors. Outcome ranges from 1 (highly unlikely) to 7 (highly likely). Statistical tests comparing all pairs of recommenders are in Appendix Table 13. All risk sets included recommendations from Trump, Fauci, the Obamas, Johnson, and Brady. Religious Catholics also included the Pope, other religious included Warren, and non-religious included Hanks.

† Regressions include recommender risk-set fixed effects.
‡ p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001.

4. Discussion

4.1 Summary

We surveyed 3,668 unvaccinated Americans in April 2021 about their likelihood of getting vaccinated, using messages with specific characteristics and celebrity endorsements. Our experiment involved 2,621 participants who were members of at least one of five important demographic segments—Black, Latinx, conservative, religious, and parents—when about half of American adults were unvaccinated.

As others have found, vaccine hesitancy is above average for Black and Latinx respondents and much higher for conservatives.

Contrary to our hypotheses, receiving more concordant messages regarding the vaccine had no detectable effect on stated willingness to vaccinate. Our sample size was large enough to detect effects (c.f., Freeman et al., 2021; Kreps et al., 2020) and Prolific is a well-regarded subject pool. While our negative results could reflect methodological issues (limitations listed below), our results suggest any effects are modest at best.

In exploratory tests, no segment had a large benefit from concordant messages. Furthermore, no message element (such as dangers of COVID-19 segment-customized or having a recommender from the same segment) had a large effect.

With caution regarding multiple-hypothesis testing, we find mixed evidence that Trump is a particularly effective recommender for alternatives (for Trump versus all others, $\chi^2 = 19.45, p = 0.007$). At the same time, only the coefficient on Fauci is significantly different from the effect of a Trump recommendation ($\beta = −0.618, 95\% CI = [−1.012, 0.223], p = 0.002$). Note that this last Fauci test was not pre-registered.

In short, the results support the hypothesis of Trump’s effectiveness with conservatives. Equally, Tom Brady and the Obamas appear roughly as effective as Trump, even among conservatives.
conservatives, and a hint that Dr. Fauci is especially unconvincing for conservatives.

4.2. Implications

Despite our findings, it remains sensible to customize messages for segments.

In October 2021, Larsen et al. (2022) treated U.S. counties with a large-scale advertising campaign featuring a COVID-19 vaccine endorsement by Donald Trump on Fox News, finding evidence of increased vaccination at average cost of about $1 per vaccination. Other studies have also found Trump promoting the vaccine has a positive effect on intent (Kreps et al., 2020; Bokemper et al., 2021). While our evidence weakly supports the effectiveness of a Trump endorsement, it is not clearly more effective than all alternatives.

We attribute this discrepancy to the timing of the studies and the impact of the message. Kreps et al. (2020) and Bokemper et al. (2021) found Trump endorsement effective for a hypothetical vaccine during Summer 2020, months before the first emergency use authorization. We sampled unvaccinated respondents in April 2021, when half of U.S. adults had been vaccinated. Our sample was thus more vaccine-hesitant than these other studies by construction. Further, political discourse had galvanized beliefs and attitudes regarding vaccination, reducing the possible effect of our study. The success of the Larsen et al. (2022) trial is likely due to their video’s effectiveness, in addition to their larger sample size.34

If public-service messages like ours cannot overcome most vaccine hesitancy, more costly interventions may nevertheless be cost-effective. For example, perhaps personal communication from friends and family or from a family doctor is more important than marketing messages.

Moving beyond traditional social-marketing approaches, evidence generally supports the effectiveness of monetary incentives and lotteries (Campos-Mercade et al., 2021; Barber and West, 2022). Tying privileges, such as school enrollment or riding commercial airlines, to vaccination status may also motivate some people (Oliu-Barton et al., 2022; Mills and Rüttenauer., 2022).

We finally consider implications for theories of identity, which are supported by both many published studies and introspection. We worry that publication bias may lead to under-reporting of other negative findings. Theories of identity are not always easy to exploit. We need much more research to explore the boundary conditions.

4.3. Limitations

The survey only reported on willingness to vaccinate, not vaccination.

In addition, the pool of Prolific respondents was not necessarily representative of their segments. Still, this is not a concern unless the resulting bias is correlated with treatment.

We defined membership in our “conservative” segment as either Trump voters or self-identified conservatives. Some Trump voters are not conservative, and vice versa.

Furthermore, our findings do not reflect the effects of any targeted messaging prior to our trial, since we collected data after half of American adults had already received at least one vaccine dose.

Finally, it is important to test additional message elements, more realistic messaging, more messengers, and in different regions.

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CRediT authorship contribution statement

J. Lucas Reddinger: Conceptualization, Methodology, Formal analysis, Project administration, Software, Validation, Investigation, Resources, Data curation, Visualization. David Levine: Conceptualization, Methodology, Formal analysis, Project administration, Funding acquisition. Gary Charness: Conceptualization, Methodology, Formal analysis, Project administration.

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 A. Messages

Table 5

Summary of possible messages by segment.

| Element name   | Segments          | Variations on text                                                                 |
|----------------|-------------------|------------------------------------------------------------------------------------|
| Population tested | All              | The vaccine has been approved by a rigorous FDA process involving tens of thousands of people. |
|                 | Black or Latinx   | The vaccine has been approved by a rigorous FDA process involving tens of thousands of people—including African Americans [Latinos]. |
| Trial results Impact | Baseline  | This randomized trial found very high effectiveness and almost no serious side effects. |
|                 | Baseline Black or Latinx | COVID-19 has infected over 30 million Americans, leading to over 500,000 deaths. |
|                 | Conservative Add: The African American [Latino/a/x] community has been especially hard-hit by this virus. |
|                 | Religious Conservative Add: Republican governors from Georgia to Ohio have stressed the economic and human cost of this pandemic. |
|                  | Parent           | The virus has spread frequently in churches [synagogues / mosques / temples]. (Photo of matching religious institution.) |

3 Even an endorsement from Trump can be met with derision from conservatives; an audience booed Trump and Bill O’Reilly when in December 2021 they revealed having received a booster shot (Calvin, 2021).

4 Note that these authors only find significance at the 80% level with randomization-unit clustering.

5 Cairo et al. (2020) and Motyl et al. (2017) address publication bias in relevant literature.
Mormons, to synagogues for Jews, and to mosques for Muslims. These quotes are fictitious. Others are actual exact quotes or nearly exact.

Notes:

Endorsers.

| Endorser | Endorsement shown                                                                 | Endorser notability                                                                 |
|----------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Dr. Anthony Fauci* | I have been waiting for this vaccine! I encourage everyone to get vaccinated as soon as possible!* | “Director of the U.S. National Institute of Allergy and Infectious Diseases (NIAID) and the chief medical advisor to the president. … The New York Times described Fauci as one of the most trusted medical figures in the United States.” |
| Dwayne “The Rock” Johnson* | I wish I had access to this vaccine before I was exposed to COVID. I encourage everyone to get vaccinated as soon as possible!* | “One of the greatest professional wrestlers of all time … His films have grossed over $10.5 billion worldwide, making him one of the world’s highest-paid actors.” |
| Donald Trump | I would recommend the vaccine to everyone, especially people who voted for me and are reluctant. It’s a safe vaccine and it’s something that works. | Former U.S. president |
| Barack and Michelle Obama | The COVID vaccine is our best shot at beating this virus, looking out for one another, and getting back to some of the things we miss. Getting vaccinated will save lives—and that life could be yours. | Former U.S. president and first lady |
| Tom Hanks* | I wish I had access to this vaccine before I was exposed to COVID. I encourage everyone to get vaccinated as soon as possible!* | “One of the most popular and recognizable film stars worldwide … Hanks’s films have grossed more than $9.96 billion worldwide.” |
| Tom Brady* | Get vaccinated so we can get our next season back to normal!* | “Brady is widely considered to be the greatest [American football] quarterback of all time.” |
| LeBron James* | Get vaccinated for our community. It is safe and will save lives!* | “Widely considered one of the greatest players in [National Basketball Association] history … selected to the All-NBA Team a record 13 times” |
| Kizzmekia “Kizzy” Shanta Corbett | I could never sleep at night if I developed anything— if any product of my science came out—and it did not equally benefit the people that look like me. Period. | “Scientific lead of the [NIH Vaccine Research Center] Coronavirus Team … propelling … a COVID-19 vaccine” |
| Bad Bunny* | I wish I had access to this vaccine before I was exposed to COVID. I encourage everyone to get vaccinated as soon as possible!* | “The first Latin urban music artist on the cover of Rolling Stone magazine … Time magazine named him one of the 100 most influential people in the world on their annual list (2020).” |
| Pastor Rick Warren* | My flock works to protect our spirits and our bodies. This vaccine is essential for protecting our bodies.* | “Founder and senior pastor of Saddleback Church, … the largest church in California … Named by Time as one of the ‘100 Most Influential People in the World.’ … His books have sold over 30 million copies.” |
| Pope Francis | I believe that morally everyone must take the vaccine. It is the moral choice because it is about your life but also the lives of others. | The Pope |
| Reverend Raphael Warnock | This pandemic isn’t over yet and we must all stay vigilant to protect our community. Follow public health guidance, stay distanced and get the vaccine when you are eligible. | “Senior pastor of the Ebenezer Baptist Church … Martin Luther King Jr.’s former congregation … United States senator from Georgia since 2021” |
| Jennifer Lopez* | I have been waiting for this vaccine! I encourage everyone to get vaccinated as soon as possible!* | “One of the highest-paid Latin actresses worldwide … a pop culture icon” |
| Alejandro Fernández* | I have been waiting for this vaccine! I encourage everyone to get vaccinated as soon as possible!* | “Sold over 20 million records worldwide, making him one of the best-selling Latin music artists.” |

Notes: Sorted by risk (descending). All endorser notability quotations come from the endorser’s Wikipedia page, accessed on 6 April 2021 and 16 March 2022. * These quotes are fictitious. Others are actual exact quotes or nearly exact.
Appendix B. Sample selection

Table 7
Risk set set for the recommendation messages.

| Selection criteria | Set of recommenders, each with equal probability |
|--------------------|--------------------------------------------------|
| Yes                | Yes Yes Yes Yes James, Corbett                   |
| Yes                | Yes Yes Yes Yes James, Corbett                   |
| Yes                | Yes Yes Yes Yes James, Corbett                   |
| Yes                | Yes Yes Yes Yes James, Corbett                   |
| Yes                | Yes Yes Yes Yes James, Corbett                   |
| Yes                | Yes Yes Yes Yes James, Corbett                   |
| Yes                | Yes Yes Yes Yes James, Corbett                   |
| Yes                | Yes Yes Yes Yes James, Corbett                   |

Table 8
Participant sampling and recruitment

| Segment           | Potential subjects | Total | Unvaccinated | Invited | Completed | Unvaccinated |
|-------------------|--------------------|-------|--------------|---------|-----------|--------------|
| Overall           | 44800              | 7932  | 4609 58%     | 4609    | 4225 92% | 4072 96%     |
| Black             | 3200               | 1599  | 916 57%      | 916     | 817 89%  | 784 96%      |
| Latinx            | 3300               | 1101  | 595 54%      | 595     | 523 88%  | 500 96%      |
| Conservative      | 2400               | 1321  | 899 68%      | 899     | 832 93%  | 816 98%      |
| Religious         | 9000               | 2032  | 783 39%      | 783     | 687 88%  | 662 97%      |
| Unvaccinated      | 4300               | 1978  | 1519 77%     | 1519    | 1467 97% | 1410 96%     |

Notes: These demographic characteristics were volunteered to Prolific by the participants prior to our survey experiment; accordingly, these characteristics are underreported. All other tables use demographic characteristics reported in our survey. We recruited only U.S. residents with a 98% approval rate on Prolific.

* Excludes any participant who shares an IP (Internet Protocol) address with another participant.

** Includes all participants who reported vaccination status, regardless of the number of surveys attempted, manipulation check, or vaccination intent.

Fig. 6. Cumulative responses over time by segment.
Fig. 7. Participant sampling flow chart.
Appendix C. Sample characteristics

Table 9  
Participants by segment.

| Segment                        | N   | Percent |
|--------------------------------|-----|---------|
| Black / African American       | 675 | 18%     |
| Latinx                         | 602 | 16%     |
| Conservative                   | 1174| 32%     |
| Religious                      | 719 | 20%     |
| Parent                         | 1093| 30%     |
| A member of no segments        | 1030| 28%     |
| Total                          | 3668| 100%    |

Notes: We collected these demographic characteristics on our experimental survey.

Table 10  
Participants by segment memberships.

| Segment count | N   | Percent |
|---------------|-----|---------|
| 0             | 1030| 28%     |
| 1             | 1425| 39%     |
| 2             | 838 | 23%     |
| 3             | 338 | 9%      |
| 4             | 37  | 1%      |
| Total         | 3668| 100%    |

Notes: We collected these demographic characteristics on our experimental survey.

Appendix D. Supplementary results

Table 11  
Effects of concordant message topics.

| Concordant messages by topic                        | Ordered logit |
|-----------------------------------------------------|---------------|
|                                                     | Intent to vaccinate self | Intent to vaccinate child |
| Population tested                                   | –0.013        | –0.005          |
| Community impact                                    | [–0.228, 0.201] | [–0.416, 0.405] |
| Children affected by COVID-19                       | 0.059         | 0.174           |
|                                                     | [–0.073, 0.191] | [–0.067, 0.414] |
| Protecting the elderly                              | 0.169         | 0.189           |
|                                                     | [–0.059, 0.397] | [–0.038, 0.417] |
| Protection from vaccine                             | –0.026        | 0.018           |
|                                                     | [–0.198, 0.145] | [–0.223, 0.259] |
| Gatherings made possible                            | –0.135        | –0.095          |
|                                                     | [–0.342, 0.075] | [–0.446, 0.256] |
| Vaccination locations                               | 0.062         | 0.058           |
|                                                     | [–0.090, 0.214] | [–0.156, 0.272] |
| Recommendation                                      | –0.026        | –0.128          |
|                                                     | [–0.223, 0.172] | [–0.356, 0.100] |
| P(all topics = 0)                                   | 0.169         | 0.054           |
|                                                     | [–0.147, 0.186] | [–0.351, 0.244] |

Notes: 95% confidence intervals in brackets using heteroskedasticity-robust standard errors. Regressions include subsegment fixed effects. Outcome ranges from 1 (highly unlikely) to 7 (highly likely). Concordant messages are the number of message components customized for that respondent’s segment memberships. Impact–Church and Gatherings–Freedom were each a separate randomization, but analyzed as part of the Impact and Gatherings bundles, respectively. For example, everyone received one of the Impact messages, and half the Religious segment also received the Impact–Churches message.

* p < 0.10, * * p < 0.05, * * * p < 0.01, * * * * p < 0.001.
Table 12
Effects of concordant messages by segment

| Ordered logit | Intent to vaccinate self | Intent to vaccinate child |
|---------------|--------------------------|---------------------------|
| **Concordant messages by segment** |                          |                           |
| Black         | 0.069                    | 0.187                     |
|               | [−0.109, 0.247]          | [−0.110, 0.484]           |
| Latinx        | 0.041                    | −0.059                    |
|               | [−0.112, 0.194]          | [−0.385, 0.267]           |
| Conservative  | 0.001                    | 0.061                     |
|               | [−0.106, 0.121]          | [−0.128, 0.249]           |
| Religious     | 0.013                    | 0.026                     |
|               | [−0.113, 0.139]          | [−0.173, 0.225]           |
| Parent        | −0.048                   | 0.008                     |
|               | [−0.165, 0.070]          | [−0.109, 0.125]           |
| **Subsegments** |                          |                           |
| (all segments = 0) | 0.908                  | 0.823                     |
| Observations  | 2621                     | 1032                      |

Notes: 95% confidence intervals in brackets using heteroskedasticity-robust standard errors. Regressions include subsegment fixed effects. Outcome ranges from 1 (highly unlikely) to 7 (highly likely). Concordant messages are the number of message components customized for that respondent’s segment memberships.

*p < 0.10, ** p < 0.05, *** p < 0.01, **** p < 0.001.

Table 13
Effects of recommenders among conservatives

| Ordered logit | Intent to vaccinate self | Intent to vaccinate child |
|---------------|--------------------------|---------------------------|
| **Panel A. The effect of recommenders on intent to vaccinate** |                          |                           |
| The Obamas    | −0.003                   | 0.281                     |
|               | [−0.092, 0.307]          | [−0.023, 0.985]           |
| Dr. Fauci     | −0.618**                 | −0.136                    |
|               | [−1.012, 0.132]          | [−0.847, 0.576]           |
| Dwayne “The Rock” Johnson | −0.305                   | −0.107                    |
|               | [−0.959, 0.386]          | [−0.990, 0.676]           |
| Tom Brady     | −0.644                   | 0.563                     |
|               | [0.030, 0.362]           | [−0.161, 1.288]           |
| Tom Hanks     | 0.332                    | 0.241                     |
|               | [−0.352, 0.089]          | [−0.618, 1.100]           |
| The Pope†     | −1.104*                  | 0.285                     |
|               | [−1.969, −0.239]         | [−0.577, 1.147]           |
| Rick Warren   | −0.208                   | 0.351                     |
|               | [−0.786, 0.369]          | [−0.577, 1.147]           |

| **Panel B. Hypothesis tests of the effect of recommenders (p-values)** |                          |                           |
| All recs. – Trump | 0.007**                 | 0.347                     |
| The Obamas – Dr. Fauci | 0.002**                 | 0.161                     |
| The Obamas – Dr. Fauci | 0.006**                 | 0.026*                    |
| The Obamas – The Rock | 0.133                   | 0.259                     |
| The Obamas – The Rock | 0.844                   | 0.351                     |
| The Obamas – The Pope | 0.013*                  | 0.691                     |
| The Obamas – Tom Brady | 0.123                   | 0.933                     |
| The Obamas – Tom Brady | 0.006*                  | 0.026*                    |
| The Obamas – Rick Warren | 0.193                   | 0.333                     |
| Dr. Fauci – The Rock | 0.269                   | 0.277                     |
| Dr. Fauci – The Pope | 0.160                   | 0.277                     |
| The Rock – Tom Brady | 0.060*                  | 0.141                     |
| The Rock – Tom Brady | 0.900                   | 0.141                     |
| The Rock – The Pope | 0.073*                  | 0.353                     |
| The Rock – Rick Warren | 0.744                   | 0.353                     |
| Tom Brady – Tom Hanks | 0.205                   | 0.420                     |
| Tom Brady – The Pope | 0.015*                  | 0.482                     |
| Tom Hanks – The Pope | 0.091*                  | 0.298                     |
| Tom Hanks – Rick Warren | 0.697                   | 0.928                     |
| The Pope – Rick Warren | 0.071*                  |                           |
| **Recommender risk-sets†** |                          |                           |
| Observations  | 4                        | 2                         |

Notes: 95% confidence intervals in brackets using heteroskedasticity-robust standard errors. Outcome ranges from 1 (highly unlikely) to 7 (highly likely). Recommend and recommender risk sets with fewer than three observations dropped.  
† Regressions include recommender risk-set fixed effects.
Appendix E. Sample screening

Prolific participants may voluntarily answer a wide variety of survey questions written by Prolific. Researchers on the platform then may arbitrarily restrict their sample to participants who respond to any of these questions as desired. Note that not all participants answer each of the questions, so demographic characteristics inferred from these questions will be naturally underreported. Regardless, we use these response data to target the demographic segments of interest to our study.

Some Prolific participants took multiple screening surveys. For example, a Black conservative may have seen two (one because they matched on Black, one because they matched on conservative). These people will have multiple segment indicators values set. In this example, the respondent would have one screening indicator for Black and one for conservative.

Meanwhile, some Prolific participants took one screening survey, then when they opened a second, they realized it was identical and they returned the survey. This is because they wanted to avoid getting a duplicate survey rejected. So participants who have multiple screening indicator values may oversample dishonest people, forgetful people, and risk-tolerant people.

Note, however, that these values are only used for initial sampling. Our survey asks all respondents to report their relevant demographics. We use these responses to our own survey in our analysis.

**Country of residence**

We restrict our sample to individuals that currently reside in the United States.

*In what country do you currently reside?*

| Response          | Participant count | Sample selection     |
|-------------------|-------------------|----------------------|
| United Kingdom    | 52285             |                      |
| United States     | 44450             | Required always      |
| Ireland           | 1761              |                      |
| Germany           | 2652              |                      |
| …                 |                   |                      |

*Note: Counts collected on 8 March 2021.*

**Black or African American**

We use the following question to target individuals who identify as Black or African American.

*What ethnic group do you belong to?*

| Response                  | U.S. participant count | Sample selection |
|---------------------------|------------------------|------------------|
| White                     | 26181                  |                  |
| Black                     | 3200                   | Selected         |
| Asian                     | 4403                   |                  |
| Mixed                     | 2694                   | Selected         |
| Other                     | 1440                   |                  |

*Note: Counts collected on 10 May 2021.*

**Latinx or Hispanic**

We use the following Prolific question to target individuals who identify as Latina/o/x or Hispanic.

*Please indicate your ethnicity (i.e. peoples’ ethnicity describes their feeling of belonging and attachment to a distinct group of a larger population that shares their ancestry, colour, language or religion)?*

| Response                                      | U.S. participant count | Sample selection |
|-----------------------------------------------|------------------------|------------------|
| African                                       | 155                    |                  |
| Black/African American                        | 2557                   |                  |
| Caribbean                                     | 250                    |                  |
| East Asian                                    | 2587                   |                  |
| Latino/Hispanic                               | 3180                   | Selected         |
| Middle Eastern                                | 314                    |                  |
| Mixed                                         | 2212                   |                  |
| Native American or Alaskan Native             | 235                    |                  |
| South Asian                                   | 964                    |                  |
| White/Caucasian                               | 22587                  |                  |
| Other                                         | 260                    |                  |
| White/ Sephardic Jew                          | 409                    |                  |
| Black/British                                 | 3                      |                  |
| White Mexican                                 | 113                    | Selected         |
| Romani/Traveller                              | 8                      |                  |
| South East Asian                              | 666                    |                  |

*Note: Counts collected on 8 March 2021.*

**Trump 2020 voters**

We target conservatives by selecting participants who reported voting for Trump in 2020.

*Who did you vote for in the 2020 US presidential election?*
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Response | U.S. participant count | Sample selection
--- | --- | ---
Joe Biden | 12337 | 
Donald Trump | 2400 | Selected
Other candidate | 837 | 
I did not vote | 2648 | 
Rather not say or N/A | 873 | 

Note: Counts collected on 8 March 2021.

**Politically conservative**

We also target conservatives who did not vote for Trump in 2020 using a political spectrum question.

*Where would you place yourself along the political spectrum?*

Response | U.S. participant count | Sample selection
--- | --- | ---
Conservative | 2131 | Selected
Moderate | 4274 | 
Liberal | 8790 | 
Other | 1153 | 
N/A | 771 | 

Note: Counts collected on 10 May 2021.

**Religious observation**

We target participants who participate in religious activities or observance.

*Do you participate in regular religious activities?*

Response | U.S. participant count | Sample selection
--- | --- | ---
Yes. Both public and private | 5384 | Selected
Yes. Public only | 830 | 
Yes. Private only | 3184 | 
None/ Rather not say | 7206 | 

Note: Counts collected on 8 March 2021.

**COVID-19 vaccine status**

Finally, we solicit some participants outside of our targeted demographic segments by seeking participants who had reported not having taken a COVID-19 vaccine dose.

*Have you received a coronavirus (COVID-19) vaccination?*

Response | U.S. participant count | Sample selection
--- | --- | ---
Yes (at least one dose) | 762 | 
No | 4349 | Selected
Prefer not to answer | 53 | 

Note: Counts collected on 8 March 2021.

**Appendix F. Consent, instructions, and debriefing**

**F.1. Consent**

All participants were shown the following consent form prior to their participation.

“This is an academic research project to study vaccination.”

“You may choose to quit at any time. You will still receive earnings for what you have completed. Risks are comparable to typical computer use. There is no direct benefit to you anticipated from your participation in this study. The data we collect will not be linked to your identity in any way.”

“If you have any questions about this research project, please contact Lucas Reddinger at reddinger@ucsb.edu.”

“If you have any questions regarding your rights and participation as a research subject, please contact the Human Subjects Committee at (805) 893-3807 or hsc@research.ucsb.edu. Or write to the University of California, Human Subjects Committee, Office of Research, Santa Barbara, CA 93106–2050.”

“Participation in research is voluntary. Clicking the button labeled “I Consent” below will indicate that you have decided to participate as a research subject in the study described above.”

**F.2. Instructions**

Participants were given these instructions:

- “This survey will take about 7 min to complete, for which you will be paid $1.25.”
- “Answer 10 demographic multiple-choice questions.”
- “Read 10 sentences of information.”
- “Answer 4 opinion-based multiple-choice questions.”
- “Answer 1 multiple-choice question about the information for a $0.75 bonus.”
- “Please complete this survey without interruption.”
After the message intervention, participants were asked the following question as a manipulation check.

“In the preceding intervention, how many Americans have died from COVID-19?”

- “Over 200,000”
- “Over 300,000”
- “Over 400,000”
- “Over 500,000”
- “Over 600,000”

F.3. Debriefing

At the end of the experiment, all participants were debriefed with the following messages.

- “It is still important to take safety precautions after being vaccinated.”
- “These recommendations will change as more people are vaccinated.”
- “Please follow updates from your public health department and the Centers for Disease Control.”
- “COVID-19 vaccination site locations vary. Please consult your doctor or local public health department.”
- “Any quotations in this survey may have been ficticious.”
- “Thank you for taking our survey.”
- “Any bonus will be paid within 48 h.”

References

Akerlof, George A., Kranton, Rachel E., 2000. Economics and identity. Quart. J. Econ. 115 (3), 715–753.
Armitage, Christopher J., Conner, Mark, 2001. Efficacy of the theory of planned behaviour: A meta-analytic review. Br. J. Soc. Psychol. 40 (4), 471–499.
Aw, Junjie, Seng, Jun Jie Benjamin, Seih, Sharma Si Ying, Lew, Lian Leng, 2021. COVID-19 vaccine hesitancy—A scoping review of literature in high-income countries. Vaccines 9 (8), 900.
Barber, Andrew, West, Jeremy. 2022. Conditional cash lottery increases COVID-vaccination rates. J. Health Econ. 81 (February), 102579.
Bikhchandani, Sushil, Hirshleifer, David, Welch, Ivo, 1992. A theory of fads, fashion, custom, and cultural change as informational cascades. J. Political Econom. 100 (5), 992–1026.
Bokemper, Scott E., Huber, Gregory A., Gerber, Alan S., James, Erin K., Omer, Saad B., 2021. Timing of COVID-19 vaccine approval and endorsement by public figures. Vaccine 39 (5), 825–829.
Bugni, Federico A., Canay, Ivan A., Shaikh, Azeem M., 2018. Inference under covariate-adaptive randomization. J. Am. Stat. Assoc. 113 (524), 1784–1796.
Cairo, Athena H., Jeffrey D. Green, Donelson R. Forsyth, Anna Maria C. Behler, and Tarah L. Raldiris. 2020. Gray (literature) matters: Evidence of selective hypothesis reporting in social psychological research. Pers. Soc. Psychol. Bull. 46 (9): 1244–1362.
Campus-Mercade, Pol, Meier, Armando N., Schneider, Florian H., Meier, Stephan, Pope, Devin, Wengstrom, Erik, 2021. Monetary incentives increase COVID-19 vaccinations. Science 374 (6569), 879–882.
Carter, Michael J., Michelle J. Mcireles. 2015. “Identity theory.” In: The Blackwell Encyclopedia of Sociology, edited by George Ritzer. John Wiley & Sons Ltd.
Charness, Gary, and Yan Chen. 2020. “Social identity, group behavior, and teams.” Annual Review of Economics 12:691–713.
Coleman, James S., 1961. The Adolescent Society. Free Press of Glencoe.
Colvin, Jill, 2021. Trump reveals he got COVID-19 booster shot; crowd boos him. The Associated Press. https://apnews.com/article/coronavirus-pandemic-health-donald-trump-coronavirus388vaccine-74abcd4e6833835f5df445fe2142e22b.
Dubre, Eve, Dominique Gagnon, Noni E. Macdonald, and the SAGE Working Group on Vaccine Hesitancy. 2015. “Strategies intended to address vaccine hesitancy: Review of published reviews.” Vaccine 33:4191–4203.
Freeman, Daniel, Bao Sheng Loe, Ly Mee Yu, Jason Freeman, Andrew Chadwick, Cristian Vaccari, Milenous Shanyinde, et al. 2021. “Effects of different types of written vaccination information on COVID-19 vaccine hesitancy in the UK (OCEANS-III): A single-blind, parallel-group, randomised controlled trial.” The Lancet Public Health 6 (5): e416–e427.
Khuchchandani, Jagdish, Macias, Ylida, 2021. COVID-19 vaccination hesitancy in Hispanics and African-Americans: a review and recommendations for practice. Brain, Behavior, Immunity Health 15 (100277).
Kreps, Sarah, Prasad, Sandip, Brownstein, John S., Hsin, Yulin, Garibaldi, Brian T., Zhang, Baobao, Kriner, Douglas L., 2020. Factors associated with US adults’ likelihood of accepting COVID-19 vaccination. JAMA Network Open 3 (10), e201594.
Larsen, Bradley, Marc J. Hetherington, Steven H. Greene, Timothy J. Ryan, Rahaan D. Maxwell, and Steven Tadelis. 2022. “Using Donald Trump’s COVID-19 vaccine endorsement to give public health a shot in the arm: A large-scale ad experiment.” Working Paper 29896. Nat. Bureau of Econ. Res., April. doi: 10.3386/w29896.
Latkin, Carl A., Dayton, Lauren, Yi, Grace, Colon, Brian, Kong, Xiangrong, 2021. Mask usage, social distancing, racial, and gender correlates of COVID-19 vaccine intentions among adults in the US. PLoS one 16 (2), e0246970.
Milligan, Megan A., Hoyt, Danielle L., Gold, Alexandra K., Hiserodt, Michele, Otto, Michael W., 2021. COVID-19 vaccine acceptance: influential roles of political party and religiosity. Psychology, Health Med. 1–11.
Mills, Melinda C., Rittenauer, Tobias, 2022. The effect of mandatory COVID-19 certificates on vaccine uptake: Synthetic-control modelling of six countries. Lancet Public Health 7 (1), e15–e22.
Mompulsair, Florence M., Haynes, Norrisa, Nkwiihorere, Hervette, Nelson, Maria, Werner, Rachel M., Jemmott, John, 2021a. Understanding drivers of Coronavirus Disease 2019 vaccine hesitancy among Blacks. Clin. Infect. Dis. 73 (10), 1784–1789.
Mompulsair, Florence M., Kuter, Barbara J., Ghadimi, Fatemeh, Browne, Safa, Nkwiihorere, Hervette, Feemster, Kristen A., Frank, Ian, et al., 2021b. Racial/ethnic differences in COVID-19 vaccine hesitancy among health care workers in two large academic hospitals. JAMA Network Open 4 (8), e2121931.
Motyl, Matt, Demos, Alexander P., Carnel, Timothy S., Hanson, Brittany E., Melton, Zachary J., Mueller, Allison B., Prims, J.P., et al., 2017. The state of social and personality science: Rotten to the core, not so bad, getting better, or getting worse? J. Pers. Soc. Psychol. 113 (1), 34.
Oliu-Barton, Miquel, Barry S.R. Pradelnski, Nicolas Woloszko, Lionel Guetta-Jeanrenaud, Philippe Aghion, Patrick Artus, Arnaud Fontanet, Philippe Martin, and Guantum B. Wolff. 2022. “The effect of COVID certificates on vaccine uptake, public health, and the economy.” Working Paper. Bruegel. https://econpapers.repec.org/RePEc:bre:wpaper:46695.
Podoshen, Jeffrey Steven, 2008. The African-American consumer revisited: brand loyalty, word-of-mouth and the effects of the Black experience. J. Consumer Marketing 25 (4), 211–222.
Reddinger, J. Lucas, Levine, David I., Charness, Gary, 2021. Can theories of social identity help increase uptake of a COVID-19 vaccine? AEA RCT Registry. https://doi.org/10.1257/rct.7479.
Reddinger, J. Lucas, Levine, David I., and Charness, Gary. 2022. (Targeted messages promoting COVID-19 vaccination). doi:10.17605/OSF.IO/CDVM.
Riad, Abouah, Abdoulaqder, Huthaifa, Morgado, Mariana, Donnorni, Silvi, Kočík, Michal, Mendes, José João, Kharg, Milosav, Kateb, Elham, 2021a. IADS-SCORE. Global prevalence and drivers of dental students’ COVID-19 vaccine hesitancy. Vaccines 9 (6), 366.
Riad, Abouah, Huang, Yi, Abdoulaqder, Huthaifa, Morgado, Mariana, Donnorni, Silvi, Kočík, Michal, Mendes, José João, Kharg, Milosav, Kateb, Elham, 2021b. IADS-SCORE. Universal predictors of dental students’ attitudes towards COVID-19 vaccination: machine learning-based approach. Vaccines 9 (10), 1136.
Romania, Rustam, Andrea Guido, Nicholas Mai, El Spiegelman, and Angela Sultan. 2021. “Increasing vaccine acceptance and uptake: A review of the evidence.” Working Paper 3839654. Social Science Research Network, May.
Sen, Amartya, 2007. Identity and Violence: The Illusion of Destiny. Penguin Books India.
Strother, Victor J., Rosenstock, Irwin M., 1997. The health belief model. Cambridge Hand. Psychol., Health Med. 113, 117.
Stryker, Sheldon, Burke, Peter J., 2000. The past, present, and future of an identity theory. Social Psychology Quarterly 63 (4), 284–297.
Tram, Khai Hoan, Sahar Saeed, Cory Bradley, Branson Fox, Ingrid Eshun-Wilson, Aaloke Mody, and Elvin Geng. 2021. “Deliberation, dissent, and distrust: Understanding distinct drivers of Coronavirus Disease 2019 vaccine hesitancy in the United States.” Clinical Infectious Diseases.

Wechsler, Howell, Wernick, Steven M., 1992. A social marketing campaign to promote low-fat milk consumption in an inner-city Latino community. Public Health Rep. 107 (2), 202–207.

Van Duyn, Mary Ann S., Tanha McCrae, Barbara K. Wingrove, Kimberly M. Henderson, Tricia L. Penalosa, Jamie K. Roys, Marjorie Kagawa-Singer, Amelia G. Ramirez, Lisa S. Wolff, and Edward W. Maibach. 2007. “Adapting evidence-based strategies to increase physical activity among African Americans, Hispanics, Hmong, and Native Hawaiians: A social marketing approach.” Preventing Chronic Disease 4, no. 4 (October): 1–11. http://www.cdc.gov/pcd/issues/2007/oct/07_0025.htm.