Economic risk framing increases intention to vaccinate among Republican COVID-19 vaccine refusers

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ABSTRACT

Objective: To determine if framing communications about COVID-19 vaccines in economic terms can increase Republicans' likelihood to get vaccinated.

Methods: We examined Twitter posts between January 2020 and September 2021 by Democratic and Republican politicians to determine how they framed the COVID-19 pandemic. Based on these posts, we carried out a survey study between September and November 2021 to examine whether motivations for COVID-19 vaccine uptake matched message frames that were widely used by these politicians. Finally, we conducted a randomized controlled experiment to examine how these frames (economic vs. health) affected intentions to vaccinate by vaccine refusers in both parties.

Results: Republican politicians were more likely to frame the pandemic in economic terms, whereas Democrats predominantly used health frames. Accordingly, vaccinated Republicans' choices were more likely to be motivated by economic consideration ($\beta = 0.25$, $p = 0.02$) and personal financial rationales ($\beta = 0.24$, $p = 0.03$). Among vaccine refusers, Republicans exposed to messages using economic rationales to encourage vaccination reported higher vaccination intentions compared to those exposed to messages using public health rationales ($F_{1,119} = 4.16$, $p = 0.04$).

Conclusion: Messages highlighting economic and personal financial risks could increase intentions to vaccinate for vaccine-hesitant Republicans.

Public health implications: Agencies should invest in developing messages that are congruent with frames that are already widely used by co-partisans. Social media may be helpful in eliciting these frames.

1. Introduction

The COVID-19 pandemic remains a global threat to lives, livelihoods, and lifestyles. According to the Centers for Disease Control and Prevention (CDC), the total number of deaths in the United States due to COVID-19 exceeded one million as of November 2022 (CDC, 2022b). The global pandemic has also imposed high economic and social costs on individuals, institutions, businesses, and communities. The economic burden associated with unmitigated COVID-19 is estimated to be a cumulative $1.4 trillion by 2030 for the United States, assuming that 60% percent of the population will be infected between 2020 and 2023 (Chen et al., 2021).

COVID-19 vaccine uptake is critical for mitigating and slowing not only the impact of the pandemic but also the risks of COVID-19 variants in the United States. To date, although more than half (68.5%) of the US population has fully vaccinated against COVID-19, less than half (49.1%) has received a booster dose, and only 8.4% have gotten an updated booster, according to the CDC (CDC, 2022a). While these vaccines have led to steep declines in COVID-19 cases and deaths, vaccine hesitancy and refusal still pose a severe threat, undermining efforts to control the pandemic. Moreover, COVID-19 may become an endemic disease, perhaps with seasonal epidemic peaks. Ongoing manifestations of severe disease combined with high levels of infection could, in turn, foster the future evolution of the virus (Telenti et al., 2021). Renewed efforts to increase vaccine uptake are therefore critical to limiting transmission and achieving long-term herd immunity.

Political orientation continues to be strongly associated with people's appraisal of the seriousness of COVID-19, and COVID-19 vaccine uptake (Bruine de Bruin et al., 2020; Fridman et al., 2021; Khubchandani et al., 2020; Khubchandani et al., 2021; Ruiz & Bell, 2021). For

instance, Republicans remain more skeptical of COVID-19 vaccines than Democrats, and make up an increasingly disproportionate share of those who remain unvaccinated and or only partially vaccinated (KFF, 2022a).

Scholars have explored why Republicans are more resistant to COVID-19 vaccines and how to increase Republicans' intentions to vaccinate. Explanations for vaccine hesitancy include a higher prevalence of misconceptions about COVID-19 among Republicans, which might drive vaccine skepticism (Kreps et al., 2021), increased acceptance of conspiracy theories (Ruiz & Bell, 2021), and greater exposure to anti-vaccine content from prominent political figures (Hornsey et al., 2020). Pink et al. (2021), found that cues from partisan elites can effectively increase vaccine intentions by invoking the partisan nature of vaccine opposition; however, Sylvester et al. (2022) contend that vaccine hesitancy would only be reduced among moderately partisan audiences. These approaches suggest that vaccine hesitancy among Republicans would remain high unless Republican elites decide to explicitly endorse vaccination; however, these endorsements have been limited in practice (KFF, 2022b).

Moving beyond endorsements from political figures, we seek to determine whether COVID-19 vaccine hesitancy associated with political partisanship can be overcome using tailored messaging strategies. Since partisanship may also exert effects on future public health efforts, we expect our findings to generalize to future health communication efforts. We therefore seek to understand the relationship between partisanship and vaccine hesitancy.

Numerous studies demonstrate that politicized and divergent party narratives about the pandemic on social media might help explain the observed partisan gap (Feng & Shao, 2022; Panda et al., 2020). Although prior authors examining traditional media sources such as newspapers and television have noted that coverage surrounding discussions of COVID-19 from March to May 2020 was highly politicized (Hart et al., 2020), studies focusing on Twitter in particular show that the Democratic party put more emphasis on public health, whereas the Republican party put more focus on national unity, China's alleged culpability for the pandemic, and the impacts of the pandemic on business (Jing & Ahn, 2021). Thus, as the pandemic unfolded, politicians used Twitter to help the public interpret events with responses increasingly divided across political ideological lines.

The highly politicized and polarized rhetoric of COVID-19 influenced views and attitudes toward COVID-19, due to differences in "issue framing." Issue framing, increasingly used in political communication (Borah, 2011) and health communication (Guenther et al., 2021), describes a process by which people develop a particular conceptualization of, or reorient their thinking about, an issue (Chong & Druckman, 2007). Issue framing affects the attitudes and beliefs of audiences, leading to behavior changes (Ajzen, 1985, 1991).

Recent research has documented the effects of issue framing on attitudes and intentions toward COVID-19 vaccines (Borah, 2022; Borah et al., 2021; Huang and Liu, 2022; Reinhardt & Rossmann, 2021; Yousaf et al., 2022); however, this literature primarily examines interventions that emphasize health-related information. Specifically, these studies suggest that framing of COVID-19 vaccination in terms of health-related risks and/or benefits may increase vaccination rates (Ashworth et al., 2021; Borah et al., 2021; Hallsworth et al., 2021; Hornsey et al., 2020; Jordan et al., 2021; Motta et al., 2021; Palm et al., 2021). For instance, messages about vaccine safety (Palm et al., 2021; Van der Linden et al., 2015), risks or benefits to self (Ashworth et al., 2021) and others (e.g., family, friends, or community members) (Duquette, 2020), and vaccines allowing life to return to normal (Hallsworth et al., 2021) have been found to increase vaccination rates and intentions. In practice, messages using these frames appear to have had limited efficacy among Republican audiences, as indicated by the partisan vaccination gap. Although some of these prior studies tested the effects of messages on small samples of self-identified Republicans, comparatively little work has examined what issue framing strategies might encourage COVID-19 vaccine uptake among Republicans, in particular.

We posit that economic-related messages might be effective for this purpose. Our rationale is as follows: compared to Democratic politicians who primarily framed vaccination in terms of reducing public health threats, Republican politicians were more likely to discuss the economic and financial costs of the pandemic (e.g., its impacts on small business, and the need for financial assistance programs). We expect that these framing choices capture the attitudes and behaviors of their partisan fellows. Combined with individual inclinations for motivated reasoning (Kunda, 1990), this influence amplifies belief differences pertaining to COVID-19 vaccination. Consequently, we expect that framing messages in health vs. economic terms would have different effects on vaccination intentions among partisans. Specifically, we posit that Republicans and Republican-leaners were more likely to view vaccination as a solution to an economic and personal financial crisis when compared to Democrats. Hence, we test the efficacy of a pro-vaccination message framed in economic terms which, we posit, might leverage Republicans' perceptions of economic and personal financial risks about COVID-19 to encourage vaccination. We anticipate that these messages might promote vaccine uptake beyond the effects of more conventional, health-framed messaging.

2. Methods

We conducted three studies to test our hypothesis. First, we conducted a retrospective observational study examining Twitter posts by Democratic and Republican politicians to determine how they framed the pandemic in public discourse. Second, we conducted a correlational study using a survey administered on Amazon's Mechanical Turk service (MTurk) – an online crowdsourcing platform – to examine the effects of economic and public health frames on COVID-19 vaccine motivations. We examined how these motivations varied between partisans. Finally, we conducted a randomized controlled experiment to examine the causal effect of these message frames (economic vs. health) on vaccine refusers among subjects who were affiliated with different political parties.

2.1. Study 1: how did partisan politicians frame the pandemic on twitter?

Using the Social Feed Manager software tool (Wrubel & Kerchner, 2020), we retrieved all available tweets containing at least one vaccine or COVID-19 keyword (see Supplementary Material) from 517 United States Senators and Representatives in the 116th US Congress. We next examined differences in how Democratic and Republican legislators framed the pandemic by comparing the frequencies of the top 15 bigrams (two-word phrases, e.g., "pandemic response") used by members of each party. We also fit a Latent Dirichlet Allocation (LDA) topic model (Blei et al., 2003) to the same dataset and compared topic proportions across legislators from each party.

2.2. Study 2: what motivated partisans to get vaccinated?

We next conducted a correlational study in which we surveyed adults in the United States and asked them whether they had received at least one dose of the COVID-19 vaccine. Subjects were recruited using MTurk between September 20, 2021, and November 5, 2021. We examined the subset of subjects who reported having gotten at least one dose of a COVID-19 vaccine and asked them to answer questions indicating their motivations for vaccination. Motivations included personal health risk – "protecting myself/not having to worry about getting sick from the virus;" public health risk – "preventing more illness and death in America;" personal financial risk – "going back to work/reducing personal financial loss;" and economic risk – "getting the economy moving again." Subjects rated their motivations on an 8-point Likert scale from 0 (not at all) to 7 (very much). The respondents were also asked their party affiliation and other demographic questions (see Supplementary Material). We analyzed these data by fitting ordinary least squares (OLS)

linear regression models to each motivation factor to test the hypothesis that Republicans were more motivated by economic and personal financial considerations, whereas Democrats were more motivated by public and personal health considerations. Specifically, we used political party as a categorical independent variable and controlled for other demographic variables, such as age, education, gender, race, and Hispanic ethnicity. We also compared the average motivations of Republicans to those of Democrats using permutation tests. Where relevant, we calculated effect sizes and provided *eta squared* results (Cohen, 1988; Tabachnick and Fidell, 2007; Thompson, 2006).

2.3. Study 3: can economic framing increase intent to vaccinate among the most resistant Republicans?

We next carried out a randomized controlled experiment to examine whether framing the decision to vaccinate in economic terms would increase Republicans' intentions to vaccinate. To do so, we invited subjects from Study 2 who had indicated that they had not been vaccinated for COVID-19 to take a follow-up survey, in which they were randomized into one of four conditions using MTurk between November 4, 2021, and November 9, 2021. Specifically, we randomly assigned these subjects into two message framing conditions: economic and health. We also manipulated whether the message included a bottom-line summary (i.e., bottom line vs. no bottom line), with these two factors fully randomized and counterbalanced, constituting a 2 x 2 full-factorial design. In this survey, respondents were shown a message corresponding to their experimental condition. After reading the message, participants were asked again about their willingness to vaccinate against COVID-19 when the vaccine was available at no cost. Next, participants were asked a series of questions designed to index their perceptions regarding personal health and financial risks and threats due to the pandemic. Specifically, we asked them to what extent they agreed with statements indicating that the coronavirus outbreak was a major risk to their personal health and personal financial situations, with all questions answered on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly disagree. All surveys included attention checks to filter out inattentive workers. Table 1 summarizes the elements of our experimental design.

To understand the efficacy of our treatment, we compared the distributions of vaccination intention before and after treatments by examining how the distribution of vaccination intention responses shifted. Specifically, we used the Cramér-von Mises (CVM) (Cramér, 1928) two-sample test to examine whether the post-treatment vaccination intention distribution differed significantly from that of the pre-treatment. We also examined whether our messages had different effects on different partisan subgroups (that is, unvaccinated Democrats given the health frame, unvaccinated Democrats given the economic frame, unvaccinated Republicans given the health frame, and unvaccinated Republicans given the economic frame). In order to examine the efficacy of our messages on the most hesitant partisans in our sample, we identified those individuals identifying as Republicans and Democrats whose pre-treatment COVID-19 vaccination intentions were "extremely unlikely," – the lowest possible rating. We refer to these subjects as the "most resistant" partisans throughout the rest of the paper. We conducted ANOVAs to test whether differences in framing changed intentions to vaccinate. Finally, we tested whether personal financial risk attitude (perceived general risks/threats to the financial conditions of individuals) mediated the relationship between economic issue framing and the likelihood of vaccination against COVID-19, using causal mediation analysis with bootstrap (Preacher & Hayes, 2004; Tingley et al., 2014). Specifically, we first fitted the mediator model where the mediator, perceived personal financial risks, was a function of the frame treatment. Next, we modeled the post-treatment vaccination intention on the mediator and the treatment. Taking these two models as inputs, we tested the significance of our mediator, perceived personal financial risks, in the relationship between having received an economic frame

Table 1

Description of information treatments and the number of participants in each treatment.

Treatment	Description	n
Health frame without bottom line	Please read the following statement. The Covid-19 pandemic has led to a dramatic loss of human life and represents an unprecedented challenge to public health in the United States. From January 3, 2020 to June 21, 2021, there have been about 33.5 million confirmed cases of Covid-19 with 601,000 deaths across the country. Currently, COVID-19 is the number one cause of death in the United States, followed by heart disease and cancer. COVID-19 also negatively affected many people's mental health and created new barriers for people already suffering from mental illness and substance use disorders. In 2020, about 4 in 10 adults in the US have reported symptoms of anxiety or depression. COVID-19 vaccines are highly effective at reducing disease incidence, protecting against severe illness requiring hospitalization and death due to COVID-19. Experts estimated that if at least 75% of the US population got vaccinated with a vaccine efficacy of 70%, then the epidemic peak can be reduced by more than 99% without other interventions.	78
Health frame bottom line	**The bottom line: By getting vaccinated, you can help to eradicate this pandemic, preventing illness and saving lives.**	72
Economic frame without bottom line	Please read the following statement. The economic impact of the COVID-19 pandemic in the US has been disruptive, affecting travel, financial markets, employment, shipping, small businesses and other industries. In 2020, the economy contracted at its deepest pace since World War 2, and the Gross Domestic Product decreased 3.5%, the biggest drop since 1946. Unemployment neared Great Depression levels. Government stimulus totaled more than $2 trillion, sending deficits to record levels. The pandemic resulted in permanent closure of roughly 200,000 US establishments in 2020. There is a consensus among economists that vaccinations will profoundly shape the course of the economic recovery. According to a brief by the University of Pennsylvania, doubling the number of vaccine doses administered daily to 3 million would create more than 2 million jobs and boost real GDP by about 1% over the summer of 2021. Business viability requires a healthy workforce.	76
Economic frame bottom line	**The bottom line: By getting vaccinated, you can help to eradicate this pandemic, ending damage to the economy.**	73

message, and the COVID-19 vaccination intention.

3. Results

3.1. Study 1

3.1.1. Sample characteristics

We collected 181,407 tweets that were posted between January 1, 2020, and September 30, 2021.123,436 (68%) tweets were from Democratic legislators, and 57,971 (32%) tweets were from Republican legislators.

3.1.2. Democratic and Republican politicians emphasized health care and the economy, respectively

Members of Congress exhibited political polarization in their communications about the pandemic and vaccination, with Democratic members emphasizing public health, health behavior, and direct aid to workers (e.g., the phrase "health care" was used 4226 times more by Democratic Congress members than Republican Congress members,
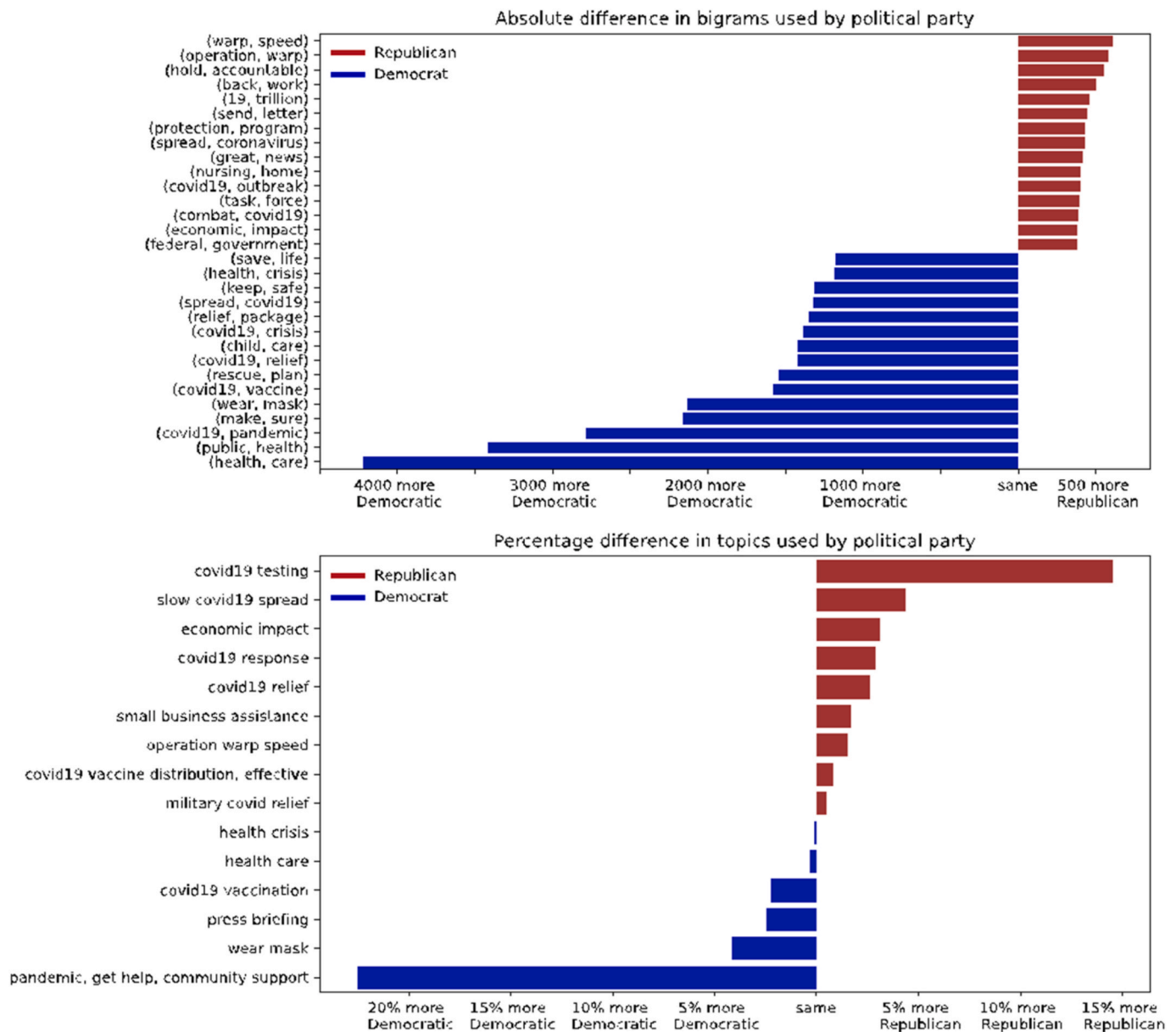
Fig. 1. Comparison of bigrams and topics posted on Twitter between Democratic and Republican members of the 116th Congress: January 2020–September 2021.

Fig. 1). The words most frequently used by Democrats concerned public health and health behavior (e.g., "health care," "wear the mask," "covid 19 vaccine," "keep safe," "save a life"). In contrast, the words most frequently used by Republicans concerned the Trump administration's successful push for the development of a COVID-19 vaccine and the economic impact of COVID-19, including financial assistance programs and reopening businesses (e.g., "warp speed," "operation warp," "back work", "economic impact"). In terms of topics, Republican politicians mentioned relief bills, economic impact, small business assistance, and operation warp speed more often. In contrast, Democratic elites focused on health crises, health care, COVID-19 vaccination, and community support.

Focusing on vaccine-related tweets, we found that Republican politicians were less likely to retweet CDC's vaccination recommendations (44% of retweets). In contrast, 56% of Democrats' retweets were CDC's official tweets, including those about the ongoing importance of COVID-19 vaccines, vaccine distribution and access, and expressing concerns about vaccine hesitancy. (A notable exception occurred in March 2020 when former President Donald Trump declared the novel coronavirus a

national emergency. During this month, Republicans elites retweeted CDC posts 86 times more frequently than Democratic politicians.) Proportionally, Republican politicians were about 7.5% more actively engaged in discussion about vaccine development, vaccine breakthroughs, vaccine completion, and vaccine effectiveness, whereas Democratic politicians were 4.5% more focused on vaccine safety, eligibility, vaccination sites and appointments, and getting vaccinated.

Taken together, we found that Democratic elites' narratives were more concerned with pandemic health risks and vaccine promotion, whereas Republicans were less engaged in discussion about vaccination, instead focusing on COVID-19 testing and the development of COVID-19 vaccines by a Republican administration. More broadly, Republican politicians discussed economic impacts, financial assistance programs, and reopening businesses.

3.2. Study 2

3.2.1. Sample characteristics
A total of 3751 individuals participated in the survey, among whom

2666 (71%) had received at least one dose of a COVID-19 vaccine. More than half of fully or partially vaccinated participants were self-identified Democrats (1614, 61.9%), 21.4% (558) were self-identified Republicans, and 16.7% (434) were self-identified political independents. Detailed sample characteristics can be found in the Supplementary Material.

3.2.2. Republicans and Democrats were motivated by the economy and public health, respectively

Linear regression results showed that vaccinated Republicans were significantly more likely to be motivated by economic ($\beta = 0.25$, p = 0.02) and personal financial ($\beta = 0.24$, p = 0.03) rationales, and less likely to agree with public health or personal sickness rationales relative to Democrats (see Fig. 2). In contrast, compared to Republicans, Democrats were more likely to be motivated by collective public health rationales, such as preventing illness ($\beta = 0.68$, p < 0.001) and death, and personal health risks, such as protecting themselves ($\beta = 0.42$, p < 0.001) (Fig. 2; see Supplementary Material).

A permutation test between Democrats and Republicans shows that Republicans' average self-rated motivations for economic and personal finance considerations were significantly higher than those of Democrats. The differences between Republicans' and Democrats' average economic and personal financial motivation responses were 0.31 points ($\eta^2 = 0.012$, p = 0.002) and 0.25 points ($\eta^2 = 0.013$, p = 0.02), respectively. In contrast, Republicans' average motivations for collective health and worry about getting sick were significantly lower than Democrats'. The differences between Republicans' and Democrats' average responses concerning public health and personal health were -0.68 points ($\eta^2 = 0.022$, p = 0.002) and -0.42 points ($\eta^2 = 0.011$, p = 0.002), respectively. For all these comparisons, we conducted post-hoc power analyses assuming a one-tailed test at a 0.01 significance level. Results showed that all the tests achieved a statistical power of above 99%. Detailed results of power analyses can be found in the Supplementary Materials.

Beyond partisan differences, we also observed that other demographic subgroups were more likely to be motivated to vaccinate by economic and financial risk perceptions. Specifically, younger adults ($\beta = -0.17$, p < 0.001), more educated individuals ($\beta = 0.2$, p < 0.001), African Americans ($\beta = 0.49$, p = 0.002), and individuals of Hispanic ethnicity ($\beta = 0.79$, p < 0.001) were all more likely to be motivated to vaccinate by economic and financial loss considerations (see Fig. 2). Importantly, most of these groups are under-vaccinated for COVID-19
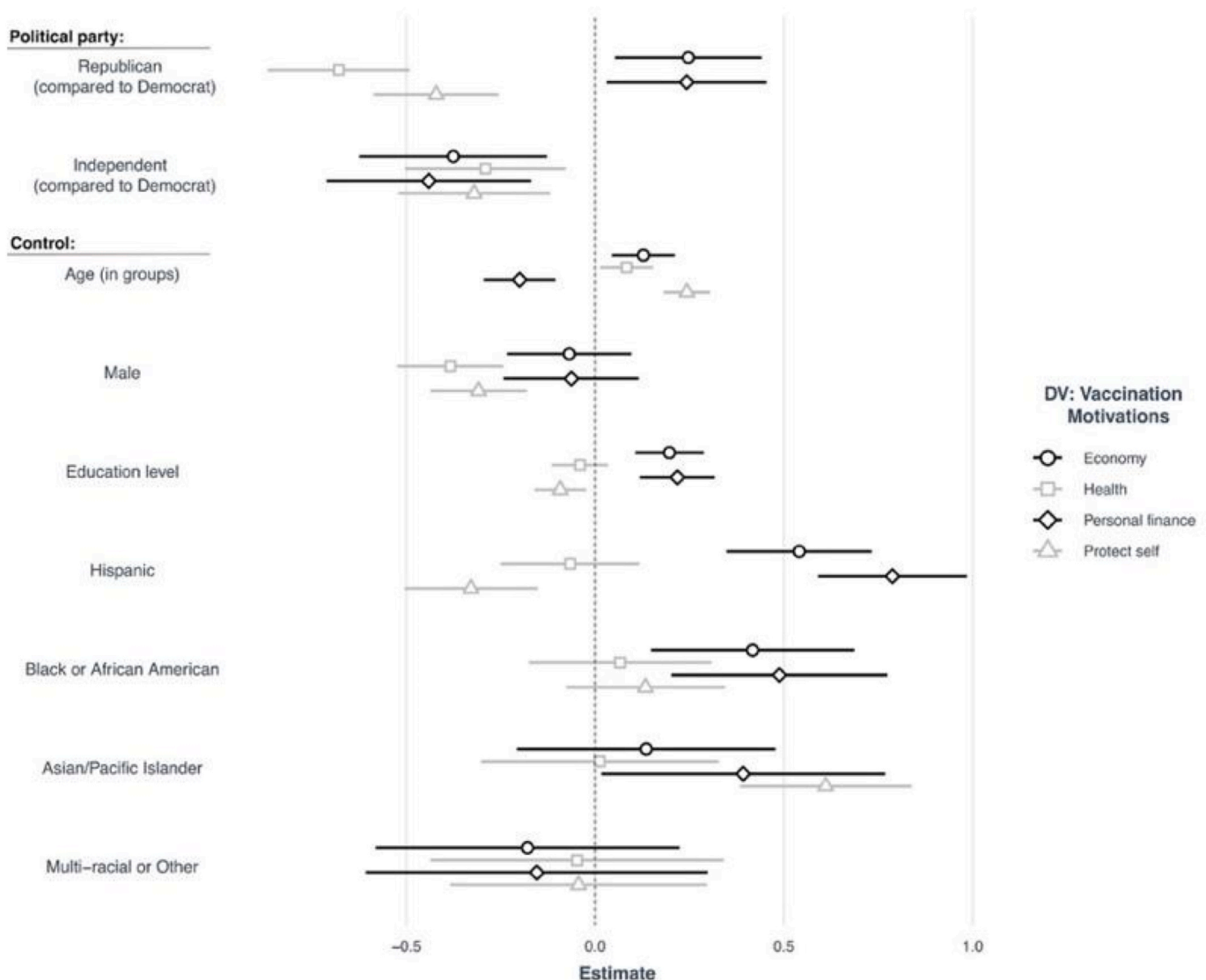

Fig. 2. Comparison of vaccination motivations between vaccinated partisan individuals: September–November 2021 (The full regression results can be found in the Supplement Material.).

([Kriss et al., 2022](); [Monte, 2021]()). Moreover, by regressing the motivation responses on vaccination status (partially vaccinated - those who got one dose of two-doses vaccine, and fully vaccinated), we found that regardless of partisanship, economic ($\beta = 0.44$, $p < 0.001$) and personal financial ($\beta = 0.62$, $p < 0.001$) rationales for vaccination were more prevalent among partially vaccinated individuals, whereas public ($\beta = -0.64$, $p < 0.001$) and personal ($\beta = -0.81$, $p < 0.001$) health rationales were more common among fully vaccinated respondents. Finally, we found that there was a strong correlation between personal financial considerations and economic considerations that motivated people to get vaccinated regardless of partisanship (Republicans: $\beta = 0.60$, $p < 0.001$; Democrats: $\beta = 0.69$, $p < 0.001$; Independents: $\beta = 0.55$, $p < 0.001$), suggesting that people who were concerned about macroeconomic conditions were more likely to consider personal financial risks when getting vaccinated.

3.3. Study 3

3.3.1. Sample characteristics

A total of 2017 individuals completed our initial screening survey of whom 400 (20%) self-identified as unvaccinated and were invited to the follow-up survey. 357 (89%) of these participants completed the follow-up, of whom 299 (84%) correctly answered all attention check questions. Roughly half (139, 46.5%) of these participants self-identified as Republican, 61 (20.4%) were Democrats, and the others (99, 33.1%) self-identified as political independents. Further sample characteristics can be found in the Supplementary Material.

3.3.2. Economic framing significantly increased intent to vaccinate among the most resistant Republicans

A balance test verified that groups did not differ significantly in terms of demographic factors, including age, gender, race, education,
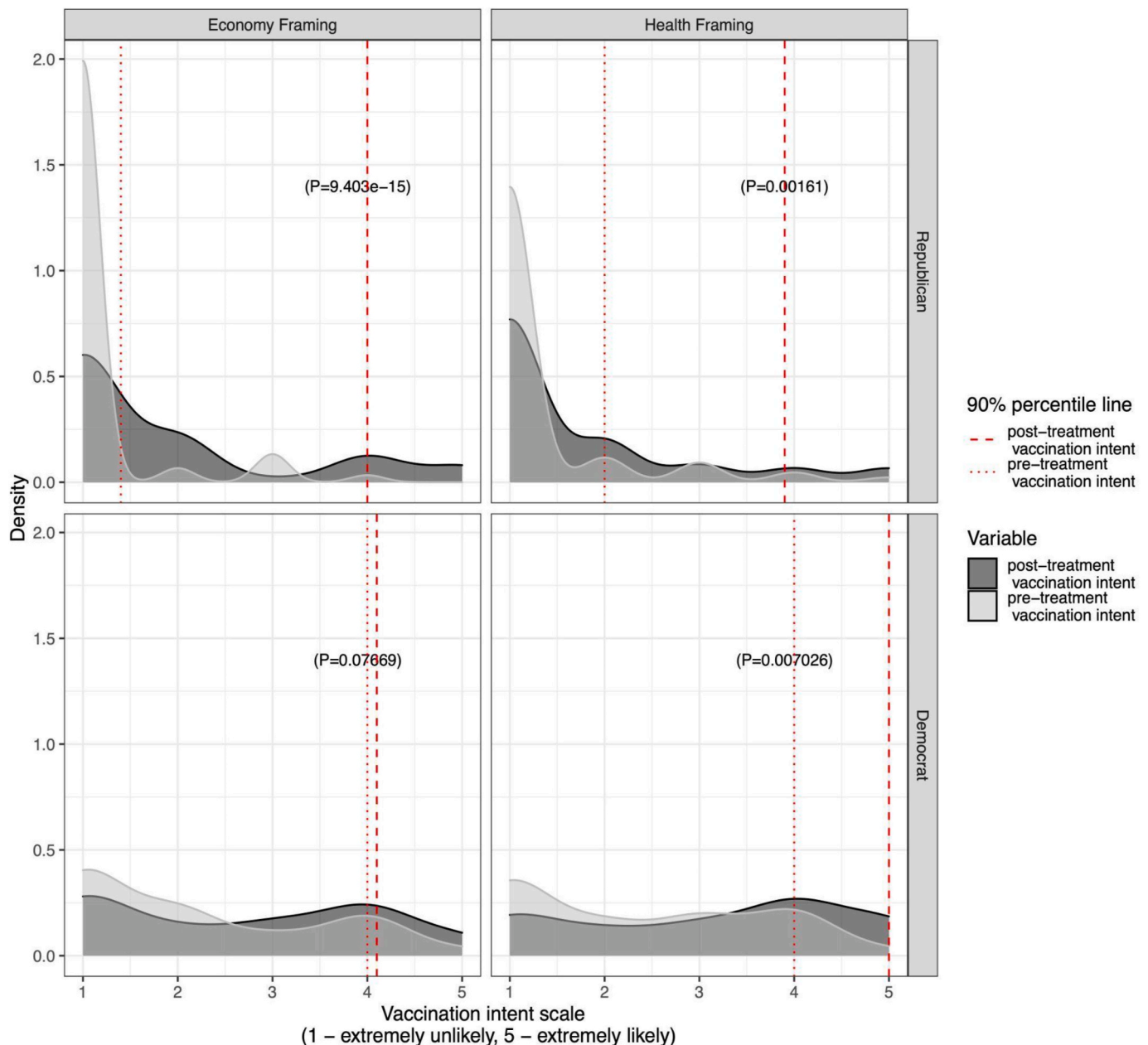
Fig. 3. Comparison of vaccine intention before and after treatment across partisan groups: November 2021. After the economic frame, the 90% percentile of Republicans' vaccination intention also increased from 1.4 to 4, compared to a smaller shift under the health frame (from 2 to 3.9). The 90% percentile of Democrats' willingness to vaccinate increased from 4 to 5 after the health frame treatment, whereas it barely changed (from 4 to 4.1) after the economic treatment.

Hispanic ethnicity, and political ideology. Details of the results can be found in the supplementary materials. We found that both economic (p < 0.001) and health (p < 0.001) frames significantly increased respondents' reported intentions to vaccinate after having seen the messages. However, we did not observe an effect of including a bottom-line summary sentence (potentially indicating that subjects understood the messages without this summary); therefore, we collapsed across this bottom-line condition on all subsequent analyses. Specifically, we conducted a one-way ANOVA comparing post-treatment vaccination intention between frames, among the most vaccine-resistant partisans (defined as a group of unvaccinated participants whose pre-treatment COVID-19 vaccination intention choice was "extremely unlikely.").

The most resistant Republicans were more likely to vaccinate after having been exposed to economic ($\delta = 2.6$; p < 0.001) and health ($\delta = 1.9$; p = 0.002) messages (Fig. 3). ANOVA results show a significant difference between frames, indicating that the most resistant Republicans were significantly more likely to intend to get a COVID-19 vaccine when shown the economic frame compared to the health frame ($F_{1,119} = 4.16$; $\eta^2 = 0.034$, p = 0.04).

For Democrats, the most resistant of respondents significantly increased their intent to vaccinate when shown the health frame ($\delta = 1.0$; p = 0.007), but we did not observe a statistically significant change for the economic frame ($\delta = 0.1$; p = 0.08). ANOVA results showed that the health frame significantly increased the most resistant Democrats' intent to get vaccinated relative to the economic frame ($F_{1,24} = 4.49$; $\eta^2 = 0.163$, p = 0.045; see the Supplemental Materials).

Upon conducting post-hoc power analyses, assuming a one-tailed test at a 0.01 significance level, we found that all tests achieved a statistical power of above 85%. Detailed results of power analyses can be found in the Supplementary Materials.

3.3.3. Economic framing drives willingness to vaccinate by increasing personal financial risk perception

We next examined the mechanism underlying why economic framing increased vaccination intentions. We found that personal financial risk perceptions mediated the relationship between economic framing and vaccination intentions. Specifically, we found that a one-point increase in perceived personal financial risk significantly increased post-treatment vaccine intent by 14% (p = 0.002). Although one might think that economic and personal financial risk questions indexed different risk perceptions a factor analysis shows that participants' perceived economic risks and personal financial risks load strongly on the same factor (see the Supplementary Materials).

Furthermore, we found that exposure to the economic frame increased participants' perceived personal financial risk by 0.41 points (p = 0.048), compared to a health frame. Finally, results of a causal mediation analysis with bootstrapping showed that perceived personal financial risk significantly mediated between the economic frame and intention to vaccinate ($\beta = 0.06$, p = 0.02; Fig. 4). To summarize, the economic frame could impact people's intention to vaccinate by increasing their perceptions of how COVID-19 exposes them to financial risk.
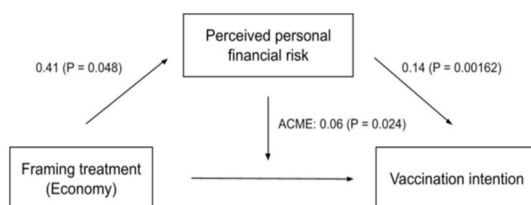

Fig. 4. Causal mediation diagram between economic frame, perceived financial risks, and vaccination intention: November 2021.

4. Discussion

This is the first study, to our knowledge, to provide evidence suggesting that messages using an economic frame may increase vaccine uptake among vaccine-hesitant Republicans. These results are consistent with our retrospective analysis of Democratic and Republican Twitter posts during the pandemic, which shows that politicians' rhetoric about the pandemic and COVID-19 vaccination utilized very distinct frames. Specifically, we found that Republicans were more likely to discuss the impacts of the pandemic in economic terms, whereas Democrats were more likely to use health frames in their public tweets. Consequently, these diverging narratives highlight a very different "subset of relevant considerations" that could influence their audiences regarding whether or not to get vaccinated.

Subjects' motivations for getting vaccinated were consistent with this political rhetoric. Among individuals who chose to vaccinate, economic rationales (e.g., getting the economy moving again, going back to work/reducing personal financial loss) for vaccination were more prevalent among Republicans, whereas public health rationales (e.g., preventing more illness and death in America, and worrying about getting sick from the virus) were more common among Democrats.

Finally, we found that messages designed to be concordant with how politicians frame the discourse around COVID-19 can increase partisans' vaccination intentions. Specifically, framing the decision to vaccinate in economic terms increased expressed intentions to vaccinate among the most resistant Republicans. These individuals appear to be concerned about the pandemic's impact on the economy and their personal financial situation. This effect was asymmetric – whereas messages using an economic frame were more effective when convincing the most vaccine-hesitant Republicans to vaccinate, those using a public health frame appear were more effective for convincing the most vaccine-hesitant Democrats.

Our results indicate that economic framing may be effective for several under-vaccinated groups, not just Republicans. These other groups – including young people, racial and ethnic minorities, and highly-educated individuals – may be more motivated by economic concerns because of structural differences. For example, individuals of lower socioeconomic status (which overlaps with age, race, and ethnicity) may suffer greater consequences for missing work, making them more sensitive to economic concerns, and thus less willing to take personal financial risks when compared to health risks. Similarly, individuals with more education may feel that they can take measures to protect their own health effectively, but may feel less control over the economy and its impact on their personal financial situation. Thus, messages targeting Republicans may also increase intentions to vaccinate for several other at-risk groups. Results from this study not only contribute to the global push for COVID-19 vaccination but may also inform future campaigns promoting vaccination and other preventive health measures to the public.

Our study is not without limitations. Specifically, we recruited subjects using MTurk, which may not be fully representative of the US population, and may be especially susceptible to economic rationales. However, this susceptibility cannot explain observed differences between Republicans and Democrats, both of whom were recruited using MTurk. Second, the effects of economic considerations on motivations to vaccinate were relatively small in the observational study (effect size η^2 ranges from 0.011 to 0.022), which may suggest limited practical application; however, these small effect sizes could also be due to the presence of several confounding factors that cannot be ruled out using a correlational design. In contrast, our randomized controlled experiment showed a larger effect (effect size $\eta^2 = 0.34$ for the most hesitant Republicans, N = 120). Given the difficulty in promoting vaccination among the most hesitant groups, the dynamics of exponential growth underlying disease spread mean that strategies with even a small effect could mean the difference between achieving herd immunity and an

uncontrolled pandemic. Thus, we should not equate small effect sizes with a lack of importance. Future work may explore the efficacy of economic framing on a more representative and larger sample, including more tailored interventions.

5. Public Health Implications

Health communicators often frame messages about COVID-19 in terms of health outcomes. However, vaccination rates differ sharply along partisan lines. Framing COVID-19 only in terms of health outcomes does not engage with one of the primary ways in which the pandemic has been framed by Republican political elites. During the 2020 presidential-election campaign, Republicans believed that the economy was the most important issue facing the nation – a position that is consistent with a reluctance to curtail their movements during the pandemic (Camobreco and He, 2022). Our results suggest that messages promoting vaccination in economic terms can encourage vaccine uptake, especially among the most resistant Republicans.

In addition to standard techniques, such as surveys and focus groups, our study also emphasizes the importance of social listening using tools such as Twitter to understand the broader discourse in which COVID-19 communication is embedded, and then testing insights from those tools using experimental techniques to derive causal conclusions. Solid data, grounded in a causal mechanism, can inform direct input into health communication campaigns that are targeted and tailored to the specific concerns of vaccine-resistant communities. Policymakers should therefore invest in developing in-house expertise for using social media platforms such as Twitter to a) listen to the concerns of vaccine-hesitant populations, b) translate those concerns into messages that are grounded in empirically-validated theoretical constructs, and c) rapidly test these messages using randomized controlled experiments. These interventions need not wait until new vaccines are developed: economic framing of COVID-19 was widespread since the pandemic began. Thus, the approach suggested here may be used to develop messages that are responsive to the concerns elicited in anticipation of novel therapeutic interventions.

Credit author statement

Wei Zhong: Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing- original draft, Writing -review & editing, Visualization, David Broniatowski: Conceptualization, Investigation, Writing- Reviewing and Editing, Funding acquisition, Data Curation.

Data availability

Research data can be found in the attached files.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2022.115594.

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