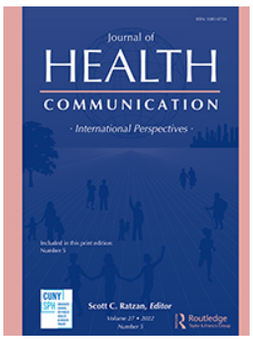

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# Ideology and COVID-19 Vaccination Intention: Perceptual Mediators and Communication Moderators

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Widespread COVID-19 vaccination is critical to slow the spread of the illness. This study investigates how political ideology is associated with COVID-19 vaccine intention via perceived effectiveness of the vaccine, perceived side effects, and perceived severity of the illness, three key aspects of the Health Belief Model (HBM). This study also examines how partisan information flow moderates the effects of ideology on these three HBM components. Using survey data collected from two battleground states in the 2020 election (N = 1849), regression, mediation and moderation analyses revealed that conservatives were less likely to intend to get vaccinated against COVID-19, and this association was significantly mediated by perceived effectiveness and perceived side effects of vaccination, as well as perceived severity of COVID-19. In addition, partisanship of news sources and discussion partners were significant moderators of ideology's association with perceived vaccine effectiveness, with conservatives viewing COVID-19 vaccination as less effective if they were frequently exposed to liberal news, and if they had frequent conversations with fellow conservatives. This suggests boomerang effects for cross-cutting mass media exposure, and reinforcement effect for interpersonal communication. Implications for efforts to promote COVID-19 vaccine uptake are discussed, including tailored and targeted campaign strategies.

Vaccination is one of the most effective ways to reduce the transmission of COVID-19, thereby slowing the pandemic. The success of the vaccine strategy, absent mandates, is based on the individual vaccination acceptance—that is, COVID-19 transmission rates will remain high until a substantial proportion of population gets vaccinated (Peretti-Watel et al., 2020). However, the long history of vaccination hesitancy in the U.S. (e.g., Franco, Mazzucca, Padek, & Brownson, 2019) has become even more salient in the context of COVID-19, given the novelty of the disease, the evolving understanding of the virus, and the unusually expedited vaccine development process (Mellet & Pepper, 2021; SteelFisher, Blendon, & Caporello, 2021). Therefore, it is critical to disentangle and specify the reasons behind COVID-19 vaccine hesitancy so that communication strategies and news reporting intended to increase vaccine uptake can be more effective.

One prominent potential driver of COVID-19 vaccine hesitancy is individuals' political ideology. Research suggested conservatives are less likely to express pro-vaccination beliefs (Baumgaertner, Carlisle, Justwan, & Rabinowitz, 2018). This disjuncture may have become more pronounced in the context of the Trump presidency and the COVID-19 pandemic, with U.S. society becoming increasingly divided by ideology (Carmines, Ensley, & Wagner, 2016; Finkel et al., 2020). The ideological division, mirroring the country's partisan polarization, deepened after the 2020 presidential election (Rucker & Costa, 2020), and science became more politicized throughout the Trump era (Woolhandler et al., 2021).

Despite the association of political ideology with COVID-19 vaccine intention, the specific cause of this relationship remains an open question. We draw on the Health Belief Model (HBM), which suggests multiple perceptual components that affect health behaviors such as vaccination (Jones et al., 2015). This study particularly focuses on three of these components: perceived benefits of a health behavior, perceived barriers of a health behavior, and perceived severity of the illness; more specifically, we examine perceived effectiveness of the COVID-19 vaccine, perceived side effects, and the perceived severity of the illness.

In addition to ideology, research shows an information environment and information uptake could also shape individuals' vaccine-related perceptions, including vaccine efficacy and safety (Hwang, 2021). Individuals tend to consume information from sources that align with their partisan position, with ideologically like-minded news consumption and interpersonal conversation serving to reinforce existing opinions (Cossard et al., 2020, May; Passe, Drake, & Mayger, 2018). In contrast, when exposed to discrepant information, psychological reactance may trigger boomerang effects (Brehm, 1966; Cho & Salmon, 2007), such that partisans hold their existing position more strongly when encountering information from ideologically incongruent sources. Thus, it is possible that conservatives might view the COVID-19 vaccine as less effective when frequently exposed to progressive news outlets or conversations

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with liberals, given conservatives tend to hold more anti-vaccine attitudes. Another possibility, however, is that a particular ideology's relationship with vaccine-related perceptions gets weaker when partisans obtain information from the other group, minimizing "echo-chambers" of ideologically consistent information. It is not clear whether, and if so, how partisan information uptake intersects with a particular ideology's impact on vaccine-related perception. Thus, the second goal of this study is to examine the moderating role of political-based information flows on the association between political ideology and vaccination perceptions.

To meet these goals, we conducted a survey in two swing states in the December following the 2020 presidential election to understand the role of ideological division in vaccination, with a focus on vaccine perceptions and political information sources. Using medication analyses, perceptions of vaccination benefits, vaccine side effects, and COVID-19 severity as mediators, we examined how ideology is associated with COVID-19 vaccine intention. Further, we consider how a particular ideology's association with vaccine perception is moderated by partisan information uptake, noting frequency of a) partisan news consumption and b) interpersonal conversation with homogeneous or heterogeneous others to examines how perceptual mediators and communication moderators shape a political ideology's influence on vaccine hesitancy.

## Ideology and Vaccination

The ideological and partisan differences in vaccine hesitancy (Franco et al., 2019; Jiang et al., 2021) correspond to the general pattern of increasing polarization in the U.S. (Finkel et al., 2020), specifically in the public health arena during the Trump era (Woolhandler et al., 2021). Political discourse on the pandemic varies across the spectrum; while Democrats tend to put more importance on public health threats, Republicans were more likely to talk about the origin of the virus or the economic impact of the shutdown on business (Green, Edgerton, Naftel, Shoub, & Cranmer, 2020). Vaccination intention is also marked by ideological division; study showed that when 26% of Republicans said they would "definitely" get the COVID-19 vaccination, 52% of Democrats said so. (SteelFisher et al., 2021). Moreover, conservatives in general are also less likely to express pro-vaccination beliefs (Baumgaertner et al., 2018). Thus, we offer our first research hypothesis, which is established and should be confirmed:

Hypothesis 1: Conservatives will have lower intentions to receive the COVID-19 vaccination than liberals.

## Ideology and the Health Belief Model

After establishing conservative beliefs as correlating to vaccine hesitancy, this study aims to disentangle the underlying mechanisms through which ideology is related to COVID-19 vaccine intention. The HBM suggests particular perceptions influence health behavioral intentions (Jones et al., 2015). This model was proposed to understand and predict individuals' preventative health behaviors (Skinner, Tiro, & Champion, 2015), containing components that explain the adoption of these health behaviors. The first two components concern perceptions of recommended health behaviors, including "perceived benefits," which pertain to a person's judgment about whether adopting the recommended health behavior would reduce the risk or seriousness of the disease, and "perceived barriers," which concern obstacles to taking action. There are also two constructs that focus on perceptions of the disease: "perceived susceptibility" pertains to beliefs about risk likelihood, or the chances of contracting an illness; and "perceived severity", which concerns belief about the seriousness of an illness. In addition, there is a "self-efficacy" component, which refers to confidence in the ability to take the recommended action, and "cue to action," which refers to cues that may trigger action (Champion & Skinner, 2008; Skinner et al., 2015).

The HBM has been used to understand preventative health behavior in various contexts, including medication adherence (Willis, 2018), breast and cervical cancer screening (Austin, Ahmad, McNally, & Stewart, 2002), and dietary adherence in diabetic patients (Piri, 2010). In the context of COVID-19 vaccination, perceived effectiveness of vaccination, perceived side effects of vaccination, and perceived severity of COVID-19 are of particular interest. Individuals who believe the vaccine provides effective protection against COVID-19 should be more inclined to receive vaccination. Indeed, people were more likely to get vaccinated for HPV when they perceived benefits of vaccination (Donadiki et al., 2014).

Conversely, people who perceive barriers to vaccination, such as side effects, might be less favorable to receiving the recommended injections. One study about influenza vaccination showed that perceived barriers, such as side effects, were negatively associated with getting vaccinated (Smith et al., 2017). This effect might be especially pronounced in the COVID-19 context; of the half of Americans who express reluctance toward getting a COVID-19 vaccine, 76% are worried about side effects (Tyson, Johnson, & Funk, 2020).

The perceived severity of COVID-19 could also play a role in vaccination inclination. During the H1N1 pandemic, pregnant women's acceptance of the H1N1 vaccine was positively predicted by perceived severity of infection (Fridman et al., 2011). In the context of COVID-19, a common perception among those denying the pandemic's severity centers on the belief that COVID-19 is a hoax or that it has been overblown (Gowen, 2020, March 19; Imhoff & Lamberty, 2020). In a survey of U.S. adults in March 2020, 29% of respondents believed COVID-19 was exaggerated to damage Donald Trump's presidency (Uscinski et al., 2020).

Existing studies suggest there is also an ideological division in the abovementioned perceptions about vaccine effectiveness, as liberals endorse statements regarding vaccination effectiveness to a larger extent than conservatives (Rabinowitz, Latella, Stern, & Jost, 2016). Moreover, an individual's political stance is also related with perceived barriers for vaccination, such as

the side effects. A survey study found that Trump supporters expressed more concerns about vaccination safety than Democrats (Hornsey, Finlayson, Chatwood, & Begeny, 2020). Furthermore, 85% Democrats thought COVID-19 was a major threat to health in July 2020, compared to only 46% of Republicans (Tyson, 2020). It is notable that while partisan identity also plays a critical role in shaping vaccination intention, we focused on political ideology, as previous research indicates attitudes toward vaccination are more complex than just the partisan divide, and political ideology is a stronger predictor of vaccine related attitudes than political affiliation in certain contexts (Latkin, Dayton, Yi, Konstantopoulos, & Boodram, 2021).

In short, conservative ideology is likely to be associated with lower vaccination intention (SteelFisher et al., 2021), shaped by perceptions about vaccine efficacy (Rabinowitz et al., 2016), vaccine side effects (Hornsey et al., 2020), and COVID-19 severity (Tyson, 2020), mediating the relationship between ideology and vaccination behavioral intention consistent with HBM (Jones et al., 2015). Accordingly, we offer the next set of hypotheses concerning the mediating role of ideological perceptions on behavior.

Hypothesis 2a-c. The effect of ideology on COVID-19 vaccination intention is mediated by the perceived effectiveness of vaccination (H2a), perceived side effects of vaccination (H2b), and perceived severity of COVID-19 (H2c).

## Ideology, Partisan Information Flow and Vaccination Perceptions

Besides individual characteristics like ideology, the information environment also shapes individuals' perception of health issues like vaccination (Hwang, 2021). The information environment for COVID-19 parallels the ideological division among partisans — existing studies reveal a partisan division in COVID-19 related news reports, as well as associations between audiences' consumption patterns and subsequent coping behavior. News outlets present COVID-19 related information in a way that aligns with party politics; Fox News use more words associated with the economy, while MSNBC uses more words associated with health implications of the virus (Muddiman, Buden, & Romas, 2020). This difference is long-standing, with 51% of the Fox News audience indicating that a "COVID-19 vaccine would be available in a year or more" compared to 78% of the MSNBC audience on March, 2020 (Jurkowitz & Mitchell, 2020, April 1). Investigations of COVID-19 coping behavior showed similar patterns, with county-level consumption of conservative media (Fox News) associated with reduced physical distancing (Gollwitzer et al., 2020). These results suggest that partisan media's coverage of COVID-19 vaccine is ideologically slanted and has the potential to shape audience' perceptions.

Another aspect of information flow is interpersonal conversation. Previous study shows interpersonal discussion affects individuals' vaccine-related perceptions (Lin & Lagoe, 2013). Since COVID-19 vaccine-related sentiment is divided along ideological lines, it is likely that people exposed to information on the liberal side would be more favorable to the COVID-19 vaccine. It is less clear though, how partisan information consumption would interact with ideology to shape vaccination perceptions and vaccination intent.

Thus, we identify two mechanisms that could potentially moderate the effect of ideology on vaccine-related perceptions. The first one is the boomerang effect, in which a message generates the opposite attitude or behavior than was originally intended (Cho & Salmon, 2007). A certain psychological reactance resulting from the message challenging a receiver's existing attitudes might point to the reasoning behind the boomerang effect (Brehm, 1966; Byrne & Hart, 2009). This effect has been previously observed in the health arena with messages promoting mammography reducing women's inclination toward mammography (Cox & Cox, 2001). It is therefore possible that if partisans are more frequently exposed to opposing views, they might hold more firmly to their own perceptions.

In another scenario, there may exist an echo-chamber that reinforces existing attitudes (Cinelli, Morales, Galeazzi, Quattrociocchi, & Starnini, 2021; Karlsen, Steen-Johnsen, Wollebæk, & Enjolras, 2017). Information uptake from one's own side would have a reinforcement effect, while information from the other side could make partisans' perceptions of vaccination become less aligned with their ideological attitudinal stance. Despite the plausibility of the boomerang effect and reinforcement effect, it is not clear which one would have more impact on vaccine perceptions. We hence propose non-directional moderation effects based on these competing mechanisms.

Hypothesis 3a-c. Liberal news consumption moderates the relationship between ideology and perceived effectiveness of vaccination (H3a), perceived side effects of vaccination (H3b), and perceived severity of COVID-19 (H3c).

Hypothesis 4a-c. Liberal political conversation moderates the relationship between ideology and perceived effectiveness of vaccination (H4a), perceived side effects of vaccination (H4b), and perceived severity of COVID-19 (H4c).

Hypothesis 5a-c. Conservative news consumption moderates the relationship between ideology and perceived effectiveness of vaccination (H5a), perceived side effects of vaccination (H5b), and perceived severity of COVID-19 (H5c).

Hypothesis 6a-c. Conservative political conversation moderates the relationship between ideology and perceived effectiveness of vaccination (H6a), perceived side effects of vaccination (H6b), and perceived severity of COVID-19 (H6c).

## Methods

### *Data and Measures*

In the month following the 2020 U.S. presidential election, we launched a web survey in the swing states of Wisconsin and Pennsylvania ($N$ = 1,849), from December 7, 2020 to

December 15, 2020, recontacting respondents from a pre-election survey. Respondents were originally recruited as part of an online panel by LHK Partners, using a nested quota sampling procedure stratified by age and gender based on Census data from the state. Participants completed the survey online. 42.6% of the respondents are male, and 90.2% are White. The average age of respondents was 56.0 (*SD* = 14.8). With regard to education, 20.8% had a high school education or less, 18.7% had some college, 13.1% had an associate degree, 30.8% had a Bachelor's degree, and 16.5% had a Master's degree, Doctoral degree, or Professional degree. Of our first study wave, 39.6% agreed to participate in wave 2, serving as respondents for this study.

### *Political Ideology*

To assess political ideology, we asked respondents to describe their political views on a 5-point scale (1 = *very liberal*, 5 = *very conservative*) (*M* = 3.3, *SD* = 0.93).

### *COVID-19 Vaccination Intention*

We assessed COVID-19 vaccination intention by asking respondents "how likely would you take COVID-19 vaccination if it becomes available"? Respondents describe their vaccination intention on a 4-point scale (1 = *not at all likely* to 4 = *very likely*) (*M* = 3.06, *SD* = 1.07).

### *Perceived Effectiveness of COVID-19 Vaccination*

On a 4-point scale, respondents indicated their perceived effectiveness of COVID-19 vaccination with the two following statements (1 = *not at all likely* to 4 = *very likely*): "to which extent do you think COVID-19 vaccination would prevent you from getting COVID-19" and "to which extent do you think COVID-19 vaccination would slow down the spread of COVID-19." These two items were averaged to construct the perceived effectiveness of vaccination (*a = 0.84, M* = 3.15, *SD* = 0.79).

### *Perceived Side Effects of COVID-19 Vaccination*

Perceived side effect was measured with the following statement on a 4-point scale (1 = *not at all likely* to 4 = *very likely*): "To which extent do you think COVID-19 vaccination would have unstated side effect to your health?" (*M* = 2.63, *SD* = 0.84).

### *Perceived Severity of COVID-19*

Three items specific to the COVID-19 context were used to assess perceived pandemic severity on a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*): "people have been too worried about COVID-19," "my state's lawmakers have been too worried about COVID-19," and "claims that COVID-19 is unusually dangerous is a hoax." They were reverse coded and merged so that higher values reflect a higher perception of severity. (α = .85, *M* = 3.77, *SD* = 1.13).

### *Partisan News Consumption*

Liberal news consumption was assessed with the following statement on a 5-point scale (1 = *never*, 5 = *always*): "How often do you read, watch, or listen to news that lean liberal?" (*M* = 2.29, *SD* = 1.13). Similarly, conservative news consumption was assessed with the following statement on a 5-point scale (1 = *never*, 5 = *always*): "How often do you read, watch, or listen to news that lean conservative?" (*M* = 2.17, *SD* = 1.08).

### *Partisan Conversation*

Conversation with liberals was measured with the following question on an 8-point scale (0 = *0 day*, 7 = *7 days*): "How many days per week do you discuss politics and current events with Democrats?" (*M* = 2.81, *SD* = 2.16). Conversation with conservatives was measured with the following question on an 8-point scale (0 = *0 day*, 7 = *7 days*): "How many days per week do you discuss politics and current events with Republicans?" (*M* = 2.5, *SD* = 1.95).

### *Demographic Variables*

Demographic characteristics, including age, gender, education, and race, were included as covariates in the analysis. Gender was coded with 0 being male and 1 being female. Race was coded with 1 being White and 0 being other racial categories.

### *Analytical Strategy*

We conducted a linear regression analysis to examine the association between ideology and COVID-19 vaccination intention and vaccine-related perceptions, using the "lmSupport" package in the R program. The mediating role of perceived effectiveness of vaccination, side effects of vaccination, and severity of COVID-19 on ideology and vaccination intention were tested using the "lavaan" package in R program. To access the mediation relationship, we tested both the indirect effect and the two-component paths a and b (Fiedler, Harris, & Schott, 2018; Yzerbyt, Muller, Batailler, & Judd, 2018). For the indirect effect, we used nonparametric percentile bootstrapping (Preacher & Hayes, 2008). Further, we tested the moderating roles of partisan news consumption and conversation by including interaction terms and ideology when predicting perceived effectiveness and side effects of vaccination and severity of COVID-19. Analyses were performed both before and after controlling for demographic characteristics. Predictors were centered to the mean when testing the moderation effects.

## Results

Conservative ideology was negatively related to COVID-19 vaccination intention ($b = -.29$, $p < .001$, $t(1, 1654) = -10.52$, $\eta_p^2 = .06$), and this relationship persisted after controlling for the demographic characteristics ($b = -.31$, $p < .001$, $t(1, 1649) = -11.72$, $\eta_p^2 = .08$), indicating conservatives had lower COVID-19 vaccination intention. In addition, individuals who were older ($b = .02$, $p < .001$), male ($b = -.36$, $p < .001$), more educated ($b = .13$, $p < .001$), and White ($b = .25$, $p < .01$) were

**Table 1.** OLS Regression of ideology on Covid-19 vaccination intention and demographic covariates

| *Variable items* | Vaccination Intention | |
|---|---|---|
| | *b* | *se* |
| *Control variables* | | |
| Age | .016*** | .002 |
| Gender | −.360*** | .050 |
| Education | .125*** | .018 |
| Race | .249** | .086 |
| *Main effects* | | |
| ideology | −.305*** | .026 |
| $R^2$ | .187 | |

Note: *$p < .05$, **$p < .01$, ***$p < .001$

**Table 2.** OLS Regression of ideology on Covid-19 vaccination related perceptions and demographic covariates

| | Perceived vaccine effectiveness | | Perceived vaccine side effects | | Perceived COVID-19 severity | |
|---|---|---|---|---|---|---|
| Variable Items | *b* | *se* | *b* | *se* | *b* | *se* |
| *Control variables* | | | | | | |
| Age | .010*** | .001 | −.005** | .001 | .013*** | .002 |
| Gender | −.159*** | .038 | .235*** | .041 | .105* | .051 |
| Education | .091*** | .013 | −.074*** | .015 | .067*** | .018 |
| Race | .069 | .065 | −.254*** | .071 | .044 | .088 |
| *Main effects* | | | | | | |
| ideology | −.194*** | .020 | .156*** | .022 | −.546*** | .027 |
| $R^2$ | .132 | | .085 | | .238 | |

Note: *$p < .05$, **$p < .01$, ***$p < .001$

more likely to have increased vaccination intention when controlling for other variables[1] (see Table 1). Thus, H1 was supported.

### *Mediational Analysis*

We tested three separate mediating models[2] to examine how perceived effectiveness of COVID-19 vaccination, perceived side effects of COVID-19 vaccination, and perceived severity of COVID-19, respectively, mediated the relationship between ideology and COVID-19 vaccination intention (H2a-c). Adopting established standards (Fiedler et al., 2018; Judd, Yzerbyt, & Muller, 2014), we only claim that the data are consistent with the hypothesized mediational relationship if the following conditions are met: ideology has an effect on vaccination intention (IV→DV), ideology has an effect on the mediator, which is the vaccine related perception (IV→mediator), the mediator has an effect on vaccination intention (after controlling for ideology) (mediator→DV), and the indirect effect is significantly different from zero. Results showed all three of the models met requirements for mediation.

For the mediation model regarding perceived effectiveness, ideology was a significant predictor of vaccination intention ($b = -.29$, $p < .001$, $t(1, 1654) = -10.52$, $\eta_p^2 = .06$) (IV→DV).

Ideology was also a significant predictor of perceived effectiveness of the vaccine ($b = -.19$, $p < .001$, $t(1, 1654) = -9.43$, $\eta_p^2 = .05$) (IV→ mediator), and this relationship persisted after controlling for demographic variables (see Table 2). In turn, perceived effectiveness was a significant predictor of vaccination intention after controlling for ideology, ($b = 1.00$, $p < .001$, $t(1653) = 44.83$, $\eta_p^2 = .55$) (mediator→DV). The indirect effect of ideology on vaccination intention through the perceived effectiveness of vaccination was also significant ($b = -.19$, 95% CI = [−.24, −.15]). H2a was then supported.

For the next mediation model using perceived side effects of the COVID-19 vaccine as a mediator, ideology was a significant predictor of vaccination intention as shown above (IV→DV), and it was also a significant predictor of perceived side effects ($b = .15$, $p < .001$, $t(1, 1654) = 6.80$, $\eta_p^2 = .03$) (IV→ mediator). This relationship still holds after controlling for demographic variables (see Table 2). Perceived side effects were also a significant predictor of vaccination intention after controlling for ideology ($b = -.64$, $p < .001$, $t(1, 1653) = -24.05$, $\eta_p^2 = .26$) (mediator→DV). In addition, the indirect effect of ideology on vaccination intention through perceptions of side effects was significant ($b = -.10$, 95% CI = [−0.13, −0.06]), supporting H2b.

When perceived COVID-19 severity served as a mediator, ideology was a significant predictor of vaccination intention as shown above (IV→DV). It also predicted perceived severity ($b = -.55$, $p < .001$, $t(1, 1654) = -20.54$, $\eta_p^2 = .20$) (IV→ mediator), and this relationship remained significant after taking demographic variables into account (see Table 2). Perceived severity was also related to vaccination behavior after controlling for ideology ($b = .44$, $p < .001$, $t(1, 1653) = 19.03$, $\eta_p^2 = .18$ (mediator→DV). The indirect effect of ideology on vaccination behavior through perceived COVID-19 severity was also significant ($b = -.24$, 95% CI = [−0.28, −0.20]). Thus, H2c was supported.

Taken together, these results showed that the perceived effectiveness of vaccination (see Figure 1(a-b), perceived side effects of vaccination (see Figure 2), and perceived severity of COVID-19 (see Figure 3) are significant mediators for the relationship between ideology and vaccination intention. These results supported H2a-c.

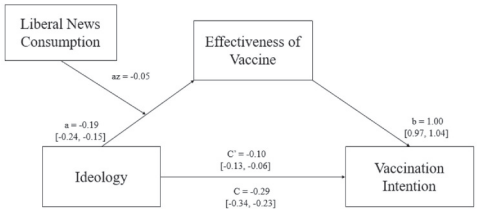
### *Moderation Analysis*

Liberal news consumption was a significant moderator for the association between ideology and perceived vaccination effectiveness ($b = -.05$, $p < .05$, $t(1, 1652) = -2.52$, $\eta_p^2 = .004$) (see Figure 4 for visualization), though this significant interaction effect disappeared when controlling for demographic variables

[1]Geographic variable (i.e., rural vs. urban division) was not a significant predictor in all of our models.

[2]For liberal news consumption's moderation effect on ideology's relationship with perceived vaccine effectiveness, the p value became marginally significant after controlling for demographic variables and the supplementary analysis did not reach significance.

*(a) Perceived effectiveness of vaccine as mediator, with liberal news consumption as moderator*




*(b) Perceived effectiveness of vaccine as mediator, with conservative conversation as moderator*

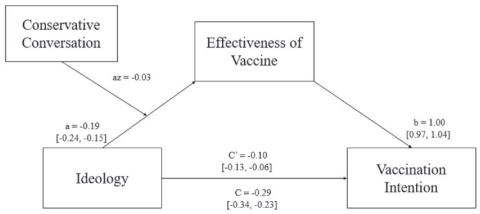



**Figure 1.** (a) Perceived effectiveness of vaccine as mediator, with liberal news consumption as moderator. (b) Perceived effectiveness of vaccine as mediator, with conservative conversation as moderator. Note (1): ideology is measured with a 5-point scale, with higher numbers indicating a more conservative ideology Note (2): effects presented in the figures do not involve demographics as control variables.

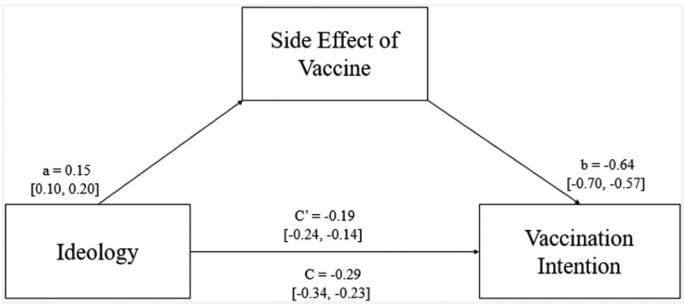



**Figure 2.** Perceived side effects of vaccine as mediator. Note (1): ideology is measured with a 5-point scale, with higher numbers indicating a more conservative ideology Note (2): effects presented in the figures do not involve demographics as control variables.

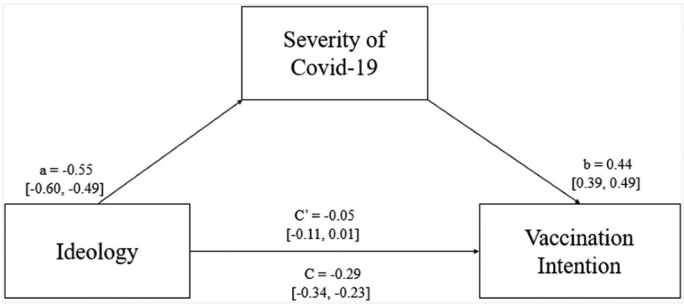



**Figure 3.** Perceived Covid-19 severity as mediator. Note (1): ideology is measured with a 5-point scale, with higher numbers indicating a more conservative ideology Note (2): effects presented in the figures do not involve demographics as control variables.

($b = -.03$, $p = .07$, $t(1, 1647) = -1.80$, $\eta_p^2 = .002$). Thus, H3a was partly supported. For the other two perceptions, neither perceived side effects of vaccination, nor perceived severity of COVID-19 was affected by the interplay between liberal news consumption and ideology. Thus H3b-c were not supported (See Table 3). Next, liberal conversation did not play any moderating roles in the relationship between ideology and perceived effectiveness of COVID-19 vaccination before or after controlling for the demographic variables, perceived side effects of COVID-19 vaccination, or perceived severity of COVID-19 (see Table 4 for details). Thus, H4a-c were not supported.

Turning to conservative information flows, conservative news consumption did not play any moderating roles in the relationship between ideology and perceived effectiveness of COVID-19 vaccination, perceived side effects of COVID-19 vaccination, or perceived severity of COVID-19 (see Table 5 for details). H5a-c were not supported. Finally, conservative conversation was a significant moderator for the relationship between ideology and perceived vaccination effectiveness both without control variables ($b = -.03$, $p < .01$, $t(1, 1652) = -2.95$, $\eta_p^2 = .005$) and after controlling for demographic characteristics ($b = -.03$, $p < .01$, $t(1, 1647) = -3.03$, $\eta_p^2 = .006$) (see Figure 5 for visualization). Thus, H6a was supported. However, conservative conversation did not moderate the relationship between ideology and perceived side effects of vaccination, nor the relationship between ideology and perceived severity of COVID-19 (see Table 6). Thus, H6b-c were not supported.

To validate partisan news exposure's moderation role on the relationship between ideology and perception of COVID-19 vaccination, we conducted a supplementary analysis using outlet specific items to measure partisan news exposure. We chose MSNBC and HuffPost as left-leaning news outlets, and Fox News and One America News Network as right-leaning outlets (Faris et al., 2017),

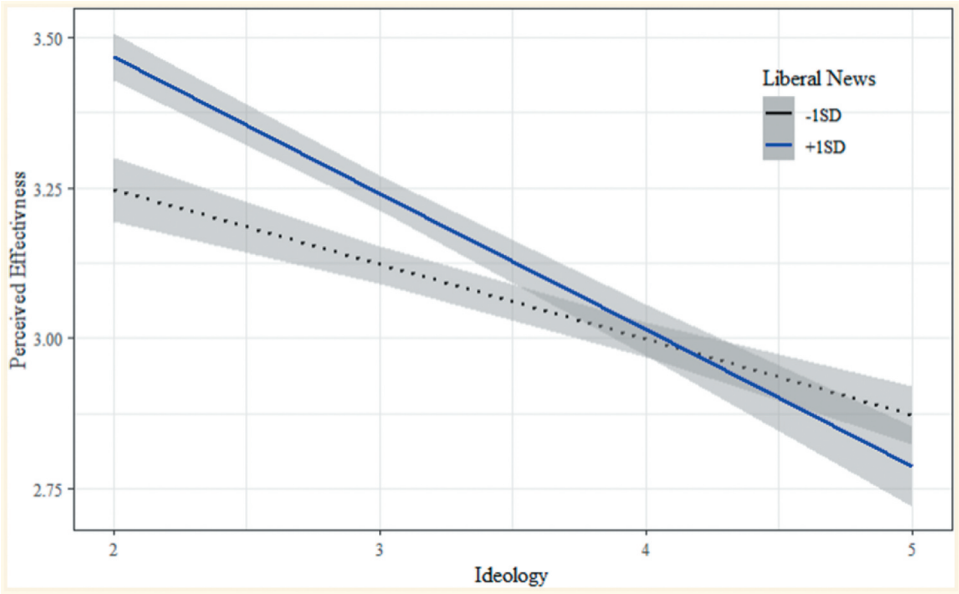



**Figure 4.** Liberal news' moderation effect on ideology's association with perceived Covid-19 vaccine effectiveness. Note: ideology is measured with a 5-point scale, with higher numbers indicating a more conservative ideology.

**Table 3.** Moderation of the effect of ideology on COVID-19 vaccination perceptions by liberal news consumption

| | Perceived vaccine effectiveness | | Perceived vaccine side effects | | Perceived COVID-19 severity | |
|---|---|---|---|---|---|---|
| Variable Items | *b* | *se* | *b* | *se* | *b* | *se* |
| *Control variables* | | | | | | |
| Age | .010*** | .001 | −.004** | .001 | .014*** | .002 |
| Gender | −.154*** | .038 | .233*** | .041 | .104* | .051 |
| Education | .089*** | .013 | −.074*** | .015 | .064*** | .018 |
| Race | .066 | .065 | −.252*** | .071 | .045 | .088 |
| *Main effects* | | | | | | |
| Ideology | −.187*** | .021 | .157*** | .023 | −.537*** | .028 |
| Liberal news consumption | .018 | .018 | .002 | .020 | .023 | .024 |
| *Interaction effects* | | | | | | |
| Ideology*liberal news consumption | −.031 | .017 | .025 | .019 | .029 | .023 |
| $R^2$ | .135 | | .086 | | .239 | |

Note: *$p < .05$, **$p < .01$, ***$p < .001$

**Table 4.** Moderation of the effect of ideology on COVID-19 vaccination perceptions by liberal conversation

| | Perceived vaccine effectiveness | | Perceived vaccine side effects | | Perceived COVID-19 severity | |
|---|---|---|---|---|---|---|
| Variable Items | *b* | *se* | *b* | *se* | *b* | *se* |
| *Control variables* | | | | | | |
| Age | .010*** | .001 | −.004** | .001 | .014*** | .002 |
| Gender | −.157*** | .038 | .235*** | .041 | .105* | .051 |
| Education | .086*** | .013 | −.072*** | .015 | .062*** | .018 |
| Race | .063 | .065 | −.247*** | .071 | .044 | .088 |
| *Main effects* | | | | | | |
| Ideology | −.175*** | .021 | .152*** | .023 | −.525*** | .028 |
| Liberal conversation | .029** | .010 | −.008 | .011 | .031* | .013 |
| *Interaction effects* | | | | | | |
| Ideology* liberal conversation | −.001 | .010 | .013 | .011 | .013 | .014 |
| $R^2$ | .138 | | .086 | | .240 | |

Note: *$p < .05$, **$p < .01$, ***$p < .001$

creating variables regarding liberal and conservative news consumption based on frequency of the readership. Analysis showed left-leaning news consumption was not a significant moderator when predicting a particular ideology's influence on perceived effectiveness, side effects, or COVID-19 severity.

In terms of the right-leaning news outlets, however, its moderation effect was significant when predicting perceived effectiveness ($b = 0.08$, $p < .01$, $t(1, 1652) = 3.27$, $\eta_p^2 = .006$), side effects ($b = -0.06$, $p < .05$, $t(1,1652) = -2.29$, $\eta_p^2 = .003$), and COVID-19 severity ($b = 0.13$, $p < .001$, $t(1,1652) = 4.06$, $\eta_p^2 = .010$). These relationships remain

**Table 5.** Moderation of the effect of ideology on COVID-19 vaccination perceptions by conservative news consumption

| | Perceived vaccine effectiveness | | Perceived vaccine side effects | | Perceived COVID-19 severity | |
|---|---|---|---|---|---|---|
| Variable Items | *b* | *se* | *b* | *se* | *b* | *se* |
| *Control variables* | | | | | | |
| Age | .010*** | .001 | −.004** | .001 | .013*** | .002 |
| Gender | −.156*** | .038 | .240*** | .041 | .075 | .050 |
| Education | .090*** | .013 | −.074*** | .015 | .073*** | .018 |
| Race | .066 | .065 | −.257*** | .071 | .063 | .087 |
| *Main effects* | | | | | | |
| Ideology | −.215*** | .022 | .150*** | .024 | −.455*** | .029 |
| Conservative news consumption | .029 | .020 | .024 | .022 | −.185*** | .026 |
| *Interaction effects* | | | | | | |
| Ideology* conservative news consumption | .027 | .018 | −.025 | .020 | .018 | .024 |
| $R^2$ | .136 | | .086 | | .261 | |

Note: *$p < .05$, **$p < .01$, ***$p < .001$

significant after controlling for demographic variables (see Appendix 1–4 for details).

## Discussion

This study deepens the understanding of political ideology as associated with COVID-19 vaccination intention. This relationship was mediated by several perceptions: perceived effectiveness and side effects of COVID-19 vaccinations, as well as perceived severity of the illness. Additionally, partisan information flows may moderate a particular ideology's relationship with these perceptions in complex ways that demand further attention.

Primarily, this study relied on components in the HBM to explain the relationship between ideology and vaccination intention. These findings went further than prior research that showed conservatives hold lower vaccination intention (SteelFisher et al., 2021), or linked health perceptions derived from HBM to predict health behaviors (Jones et al., 2015). The current findings not only demonstrate that perceived effectiveness, perceived side effects, and perceived severity predict COVID-19 vaccination intention, but also that one's ideological stance influences vaccination intention by shaping critical perceptions about the vaccine and the virus.

There were also two significant moderators in partisan information flow for the relationship between ideology and perceived vaccine effectiveness. In terms of news consumption, conservatives consuming liberal news tend to see the vaccine as less effective. Though this result needs to be interpreted with caution, this pattern indicates a potential boomerang effect, in which individuals' beliefs are strengthened by exposure to opposing views. This result is consistent with a previous finding that exposure to incongruent information may increase polarization, and this effect is more prominent for Republicans (Bail

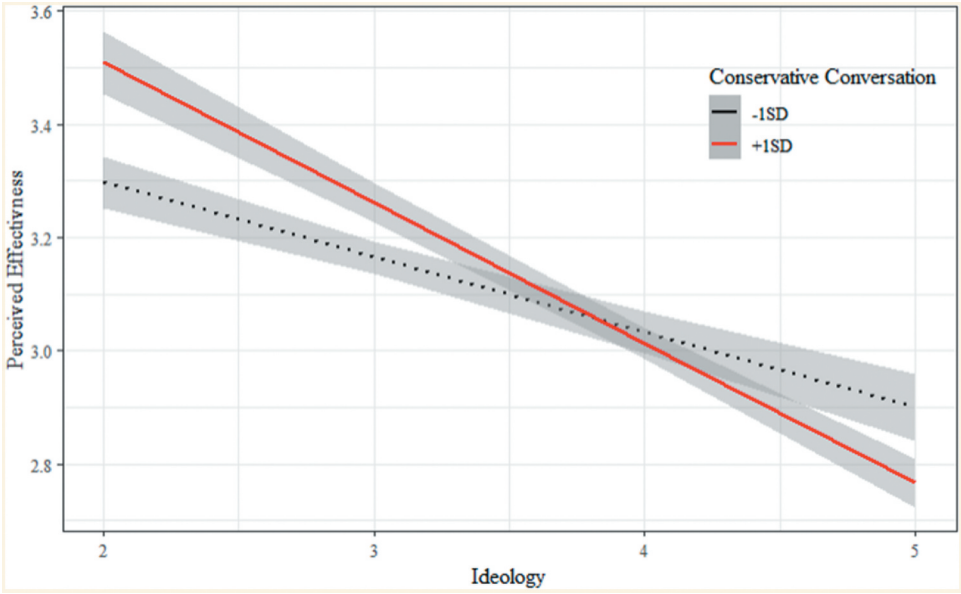



**Figure 5.** Conservative conversation's moderation effect on ideology's association with perceived Covid-19 vaccine effectiveness. Note: ideology is measured with a 5-point scale, with higher numbers indicating a more conservative ideology.

**Table 6.** Moderation of the effect of ideology on COVID-19 vaccination perceptions by conservative conversation

| | Perceived vaccine effectiveness | | Perceived vaccine side effects | | Perceived COVID-19 severity | |
|---|---|---|---|---|---|---|
| Variable Items | *b* | *se* | *b* | *se* | *b* | *se* |
| *Control variables* | | | | | | |
| Age | .011*** | .001 | −.004** | .001 | .012*** | .002 |
| Gender | −.154*** | .038 | .233*** | .041 | .112* | .050 |
| Education | .090*** | .013 | −.077*** | .015 | .078*** | .018 |
| Race | .060 | .065 | −.260*** | .071 | .071 | .087 |
| *Main effects* | | | | | | |
| Ideology | −.194*** | .021 | .143*** | .023 | −.494*** | .028 |
| Conservative conversation | .017 | .010 | .016 | .011 | −.067*** | .014 |
| *Interaction effects* | | | | | | |
| Ideology*conservative conversation | −.029** | .010 | .008 | .011 | −.016 | .013 |
| $R^2$ | .137 | | .087 | | .253 | |

Note: *$p < .05$, **$p < .01$, ***$p < .001$

et al., 2018). It suggests that exposing conservatives to cross-cutting news content may not address vaccine hesitancy among this group. On the other hand, consumption of conservative media either do not have effect on perception of vaccination, as shown in the major analysis; or have the potential in making extreme conservatives perceive more vaccine effectiveness and less side effects, though not necessarily the case with perceived Covid-19 severity, as shown in the supplementary analysis. These findings suggest that the far-right news outlets, while may not putting emphasis on the severity of COVID-19, still followed the norm and did not outright downplay the COVID-19 vaccine. More importantly, for extreme conservatives, an ingroup news resource would be important for them to give credit to the information in news.

Conservatives engaging in like-minded conversation perceived lower effectiveness of COVID-19 vaccination, suggesting a reinforcement effect (Karlsen et al., 2017). Moreover, in contrast with the roles of partisan news, conversation with liberals did not create boomerang effect for extreme conservatives, possibly because either (a) the "in person" component of the communication reduces salience of group identity and alleviates reactance (Wojcieszak & Warner, 2020), or (b) vaccination topics were avoided in the conversation between partisans to reduce conflict.

Taken together, these findings indicate that COVID-19 vaccination intention could be promoted by altering individuals' perception of vaccination effectiveness, vaccine side effects, and COVID-19 disease severity. These results also hint at different strategies to promote vaccination among liberals and conservatives. For liberals, the key to driving vaccination intention requires maintaining perceptions of a vaccine with limited risks that can effectively combat a severe illness; for conservatives, the first step would be improving the perception of vaccine efficacy, side effects, and COVID-19 severity, while recognizing cross-cutting news exposure may trigger a boomerang effect, and news resources with a consistent ideological stance would work better. These findings suggest that certain communication strategies work better for one group than another, and that additional attention could be given for choosing information sources when promoting vaccination among the conservatives.

## Limitations and Future Directions

This study has several limitations. First, all the measurements are self-reported, and there might be a gap between reported perceptions and intention relative to actual ones due to mechanisms such as social desirability (Sjöström & Holst, 2002). Second, our analysis is based on a cross-sectional survey, which could not allow for causal inference. Future research could use other methods, such as experiment, to examine whether the relationships revealed in this study are causal. Third, we did not include all components of HBM, like self-efficacy and susceptibility components. We also assessed COVID-19 severity perception with a context-specific measure assessing whether others were "too worried about COVID-19" and that it was a "hoax," which is different from traditional severity method that pertains to severity of the disease. Moreover, we used a single item to measure the side effects component. Future work could also consider using the original HBM measures in a comprehensive and consistent way and improving measurement correspondence with the HBM.

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## Supplementary Material

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