



Building on West Virginia's innovative COVID-19 public health communication: associations between vaccination beliefs and vaccination messaging, partisanship, and social vulnerability[☆]

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ABSTRACT

Background: Building on our previous theory-guided research findings, this study investigated differences in COVID-19 vaccination-related beliefs across a number of relevant types of communication such as provider recommendations and aided recall of various vaccination campaign assets. We also explored the potential roles of political affiliation and social vulnerability in vaccination beliefs.

Methods: A cross-sectional survey of West Virginia residents was administered in January 2022 online and via phone interview by Research America, Inc. ($N = 756$).

Results: About 71 % of respondents had received at least one COVID-19 vaccine dose at the time of the survey. Two-thirds of the sample reported having a healthcare provider recommend vaccination, and around two-thirds reported seeing a vaccination TV advertisement. Despite varying strength of beliefs across political groups, there was a general openness to choosing to vaccinate against the virus that causes COVID-19, which reflects a social landscape conducive to vaccination communication and points toward the importance of understanding unique population segment needs, wants, and reservations, as well as the messengers from whom they trust to receive such information. Healthcare provider recommendation was consistently associated with stronger vaccination-related intentions and beliefs. Most observed differences in vaccine-related beliefs were between those who reported being politically liberal compared to both those who reported being politically moderate and politically conservative. Politically moderate and conservative participants, however, did not vary from one another. Social vulnerability index was mostly unrelated to vaccination beliefs.

Conclusion: Participants had overall relatively supportive vaccination-related beliefs. While partisanship played some role surrounding vaccination-related beliefs, even politically conservative groups still exhibited positive attitudes and intentions toward vaccination—albeit to a lesser degree than their liberal counterparts. The social landscape was at least conducive to vaccination communication. Findings build on previous theory-driven communication science scholarship and hold practical implications for communication messengers and channels for ongoing health communication in a rural Appalachia.

1. Introduction

The West Virginia (WV) Prevention Research Center used funding through the PRC Vaccine Confidence Network to partner with the West Virginia University Public Interest Communication Research Lab (WVU PIC Lab) and their ongoing efforts promoting COVID-19 vaccination through the state's Joint Interagency Task Force on COVID-19 alongside the WV Department of Health and Human Resources (now WV Department of Health) and the Center for Rural Health Development, Inc.

Much of this research was grounded in common theoretical

frameworks in public health, including the Reasoned Action Approach [1], a more recent iteration of the Theory of Planned Behavior, and the Extended Parallel Process Model [2], a more recent iteration of the Health Belief Model (see [3,4] for complete theoretical framework). This ongoing formative and process evaluation research has yielded numerous translational products (e.g., [5]) as well as several academic manuscripts and research reports that provide insight into West Virginians' vaccination-related beliefs. Such research found that subjective norms (i.e., the belief that important others expect you to get vaccinated), perceptions of vaccination effectiveness, and positive feelings toward COVID-19 vaccination statistically predicted unvaccinated

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adults' intention to get vaccinated and statistically predicted whether adults had been vaccinated already [3,4]. Another study found that vaccinated adults aged 55 years and up, an age group particularly vulnerable group to COVID-19 complications, were similarly more likely to have received a COVID-19 vaccine booster dose and more specifically an Omicron-specific booster (relevant terminology at the time) when they perceived greater subjective norms and, importantly, reported having a conversation about the updated booster shot with a healthcare provider [3].

Building on such past findings, the current study seeks to investigate differences in vaccination-related beliefs across a number of relevant types of communication. Specifically, we look at the extent to which these beliefs vary based on a healthcare provider recommending vaccination and across aided recall of various statewide communication campaign assets (e.g., vaccination advertisement on streaming services or in newspapers, live readings of scripted advertisements by popular state radio hosts, billboards placed across the state, visiting the campaign/state website, and so on). In doing so, we show evidence of the effectiveness of this state-specific campaign and the importance of tailored vaccination communication.

2. Vaccination and politics

In addition to recall of vaccination communication, a goal here is also to further investigate the potential role/impact of politics as they relate to vaccination beliefs and possible responses to campaign messaging. Several studies (e.g., [6,7]) and ongoing polling (e.g., [8]) highlight a partisan divide in vaccination opinions and behavior. Those data are often focused on the national level and do not necessarily investigate possible impacts on the motivations and beliefs that precede choosing vaccination (see [3,4]). As such, this paper measures both identification with the major U.S. political parties, as well as political ideology more generally.

3. Social vulnerability

Lastly, a major indicator of pandemic and other disaster risk is the CDC's Social Vulnerability Index (SVI) [9]. This indicator has been used to assess where vaccination coverage and initiatives ought to be targeted to serve the most vulnerable populations (e.g., [10]), but not necessarily in how vaccination communication may be differentially effective. We therefore assess the extent to which vaccination communication might interact with the relative vulnerability of the regions in which participants reported living.

RQ1: *To what extent do vaccine-related beliefs (i.e., attitude toward vaccination, perceived vaccination effectiveness, vaccination social norms, COVID-19 risk perceptions) vary based on a) their healthcare provider's communication about vaccination, and b) recall of campaign communication?*

RQ2: *To what extent do vaccine-related beliefs (i.e., attitude toward vaccination, perceived vaccination effectiveness, vaccination social norms, COVID-19 risk perceptions) vary based on self-reported political ideology?*

RQ3: *To what extent do vaccine-related beliefs (i.e., attitude toward vaccination, perceived vaccination effectiveness, vaccination social norms, COVID-19 risk perceptions) vary based on the SVI of participants' self-reported county of residence?*

4. Materials and methods

A cross-sectional survey, approved by the authors' university IRB, was administered January 19–31, 2022 by Research America, Inc. The survey was conducted online (convenience sample from Research America's online panel of ~20,000 WV residents; $n = 370$, ~2 % response rate) and via a combination of random digit-dialed landline ($n = 174$, ~1 % response rate from 18,432 random landlines) and mobile phone interviews ($n = 212$, ~1 % response rate from 20,486 random

cellphones). Participants were required to be WV residents at least 18 years of age. See Totzkay et al. (2024) for full methodological detail.

4.1. Measures

4.1.1. Vaccination communication

Recall of vaccination communication was measured by asking participants whether they had seen, had not seen, or could not recall if they had seen ten campaign assets deployed across WV. These included visiting the state's COVID-19 vaccination website (vaccinate.wv.gov), viewing the Frequently Asked Questions resource page on up-to-date COVID-19 vaccination information from the state's Department of Health, seeing the campaign “hashtag” on social media (#CommunityImmunityWV), seeing a billboard with the campaign hashtag and/or the state website, seeing a video on streaming services or social media of West Virginians explaining their reasons for getting vaccinated (reflecting a specific campaign effort at the time), heard about vaccination on a major radio station that had hosts reading a script encouraging vaccination (hereafter termed a “live read”), and seeing an advertisement encouraging vaccination from the state's Department of Health on the Internet, on television, in a local newspaper, or heard via audio streaming or radio.

Finally, participants were asked if a health care provider had recommended that they get vaccinated, had not recommended that, or if they could not remember. In all cases, responses were recoded so that having not seen/heard or not being recommended and not remembering were combined and compared against reporting recall.

4.1.2. Vaccination beliefs

Measured vaccination beliefs were adapted from existing health promotion frameworks (see Totzkay et al., 2024) and included how serious of a threat the participant believed COVID-19 to be and the extent to which they believed they were likely to get COVID-19, their perceived effectiveness of COVID-19 vaccination in protecting them, the extent to which they believed others were choosing vaccination (i.e., descriptive norms) and expected them to choose vaccination (i.e., subjective norms), their perceived usefulness and safety of vaccination (i.e., instrumental attitude) and positive feelings/affect toward vaccination (i.e., affective attitude), and their intention to choose to be vaccinated against the virus that causes COVID-19. All items were measured on 7-point scales.

4.1.3. Political party identification

Political party identification (adapted from the American National Election Studies; <https://electionstudies.org/data-center/>) was measured by asking participants to report whether they identified as a Republican, Democrat, Independent, or Other. For those selecting Republican or Democrat, they were asked whether they were “Strong” or “Not Very Strong” regarding that party. Those who reported being Independent or Other were asked to report whether they were closer to the Democratic Party, closer to the Republican Party, or neither. These responses were coded to create a 7-point scale ranging from “Strong Democrat” (1) to “Strong Republican” (7), with Independent/Other response of “Neither” as the scale midpoint (4). For the purposes of this study, all responses under the scale midpoint were coded into a single “Democrat” category (1), Neither was retained as a unique category of “Independent” (2), and all scores above the midpoint were recoded as “Republican” (3). While creating a categorical variable here attenuates any possible association between this and other study variables, this variable was recoded to compare political groups and yield audience segmentation insights.

4.1.4. Political ideology

Finally, political ideology (adapted from the American National Election Studies; <https://electionstudies.org/data-center/>) was measured by participants rating themselves on a 7-point scale from

“Extremely Liberal” (1) to “Extremely Conservative” (7). They could also report having not thought much about it, which lead to reporting, “if [they] had to choose,” being “Conservative” (recoded to 5 = “Slightly Conservative”), “Liberal” (recoded as 3 = “Slightly Liberal”), or “Moderate” (recoded as 4 = “Moderate”). For the purposes of this study, all responses under the scale midpoint were coded into a single “Liberal” category (1), Moderate was retained as a unique category of “Moderate” (2), and all scores above the midpoint were recoded as “Conservative” (3). Just as with political party identification, this variable was recoded into a categorical variable specifically to identify audience segmentation insights.

4.1.5. Social vulnerability index

All participants selected where they lived from a closed-ended list of all 55 counties, which had originally been used to ensure relative geographical representation within WV. The SVI category (i.e., “0.0 - .250000,” “.250001 - .500000,” “.500001 - .750000,” “.750001 - 1.0”) for each WV county was identified (https://www.atsdr.cdc.gov/placeandhealth/svi/publications/publications_materials.html) and matched to participants' reported county.

5. Results

The sample ($N = 756$) predominantly identified as White/Caucasian (89.7 %, $n = 678$) – relatively aligned with state race/ethnicity demographics (U.S. [11]), with ages ranging from 18 to 99 years ($M = 48.06$ years, $SD = 17.47$). More than half of the sample identified as women (51.2 %, $n = 357$) and having received at least one COVID-19 vaccine dose (71.6 %, $n = 499$). Most reported having had some college, but no degree (27.4 %, $n = 207$) or being a high school graduate (27 %, $n = 204$).

Most respondents reported not having a college degree (66.3 %, $n = 501$) and earning less than \$50,000 annually (61.5 %, $n = 400$). A plurality of respondents reported being employed as an hourly employee (26.2 %, $n = 198$) or being retired (21 %, $n = 159$). The sample comprised self-identified Republicans (45.6 %, $n = 345$), Democrats (32.7 %, $n = 247$), and Independents (21.7 %, $n = 164$). Respondents further reported being Politically Moderate (approx. 41.3 %, $n = 312$), Conservative (approx. 36.1 %, $n = 273$), or Liberal (approx. 36.1 %, $n = 273$). A plurality of participants reported living in counties that fell into the SVI category of “.500001 - .750000: (39.68%, $n = 300$), followed by “.750001 - 1.0” (28.04 %, $n = 212$), “.250001 - .500000” (17.99 %, $n = 136$), and “0.0–0.2500000 (14.29 %, $n = 108$).

5.1. Recall of vaccination communication

Table 1 shows the proportions of the sample who recalled each type of vaccination communication, ordered from most to least frequently recalled. Just over two-thirds of the sample reported having a healthcare provider recommending vaccinations, and just under two-thirds reported having seen a vaccination advertisement on TV. The lowest rate of recall included active seeking of information on webpages and recall of campaign billboards, though these were still reported at a level that allowed for statistical analysis.

To explore possible associations between communication recall and vaccination-related beliefs, a series of between-subjects *t*-tests were conducted. Several patterns worth noting can be observed across Tables 2–5. First, seen in Table 2, intention/motivation to get vaccinated, among participants who had not yet been vaccinated against COVID-19, was the least consistent vaccination-related belief to vary. Table 3 shows that in all cases other than recall of audio streaming/radio advertisements, negative emotions (e.g., fear, worry) toward COVID-19 were stronger for participants who recalled vaccination communication than those who did not. Finally, seen in Table 5, there are consistent differences across communication outcomes on both descriptive and subjective norms; in every instance, participants who recalled

Table 1

Reported recall of COVID-19 vaccination communication, ordered by relative frequency.

	Percent (Frequency)
Healthcare Provider Recommended Vaccination	67.20 % ($n = 508$)
Saw a COVID-19 vaccination advertisement on TV.	62.57 % ($n = 473$)
Heard a COVID-19 vaccination advertisement on an audio streaming service/radio	42.59 % ($n = 322$)
Heard about COVID-19 vaccination via radio live read	41.93 % ($n = 317$)
Saw a COVID-19 vaccination advertisement from the WV DHHR on the Internet	41.27 % ($n = 312$)
Saw video of West Virginians explaining why they got the COVID-19 vaccine, on streaming services or social media (e.g., YouTube, Facebook, Twitter, Instagram)	38.10 % ($n = 288$)
Saw a COVID-19 vaccination advertisement in a local newspaper.	33.20 % ($n = 251$)
Viewed COVID-19 Vaccines Frequently Asked Questions (FAQs) page	28.57 % ($n = 216$)
Visited state vaccination website	27.51 % ($n = 208$)
Saw campaign-related billboard	27.25 % ($n = 206$)
#CommunityImmunityWV	21.16 % ($n = 160$)

vaccination communication perceived more strongly that people important to them were choosing vaccination and that people important to them thought that they should choose vaccination, compared to those who did not recall communication. These cases generally had large effect sizes, ranging from Cohen's $d = \sim 0.20$ to ~ 0.80 . Otherwise, there was a range of differences across outcomes, generally reflecting stronger beliefs when communication was recalled. (See Table 6.)

Examining Tables 2–5 further shows the consistency of several communication variables. In every case other than unvaccinated participants' vaccination intention, reporting that a healthcare provider had recommended vaccination was associated with stronger vaccination-related beliefs. Effect sizes for these differences ranged from Cohen's $d = \sim 0.25$ to ~ 0.80 . The same pattern, with a somewhat lower range of effect sizes (i.e., Cohen's $d = \sim 0.13$ to ~ 0.40) was observed for those who reported hearing about COVID-19 vaccination via radio live-reads. Finally, reportedly visiting the campaign/state website on COVID-19 vaccination was also associated with strong vaccination-related beliefs in all cases other than beliefs that one was likely to get COVID-19 (i.e., perceived susceptibility).

5.2. Differences by politics

To explore differences in vaccination-related beliefs by politics, a series of one-way Analyses of Variance (ANOVAs) were conducted for both political party identification and for political ideology. Tables 7 and 8 report only those instances where there were statistically significant differences in vaccination-related beliefs. In the case of political ideology, most observed differences were between those who reported being politically liberal compared to both those who reported being politically moderate and politically conservative. Politically moderate and politically conservative participants, however, did not vary from one another. The same pattern was seen for political party identification, such that those who identified as Democrat varied from those who identified as Independent or Republican, but the latter two did not vary from one another.

Generally speaking, participants who reported being politically liberal or identified as Democrat reported stronger vaccination-related beliefs than their counterparts. However, when these differences were largely in magnitude and not direction; the only case in which supportive beliefs were not observed, on average, was for beliefs about the

Table 2

Comparison of intention to get vaccinated and boosted across communication recall, with t-tests, means, standard deviations, and 95 % confidence intervals.

		Vaccination Intention	Booster Intention
Saw advertisement on Internet	Yes	2.36 (1.71) [2.03, 2.69]	5.16 (1.74) [4.78, 5.52]
	No	2.61 (1.72) [2.36, 2.86]	4.66 (1.83) [4.35, 5.01]
	<i>t</i> (<i>df</i>)	−1.16 (276), <i>p</i> = .12	1.82* (180)
Saw advertisement on TV	Yes	2.36 (1.66) [2.11, 2.64]	4.94 (1.84) [4.60, 5.28]
	No	2.71 (1.77) [2.42, 3.04]	4.75 (1.75) [4.36, 5.15]
	<i>t</i> (<i>df</i>)	<i>t</i> (276) = −1.71*	0.69 (180), <i>p</i> = .25
Saw advertisement in local newspaper	Yes	2.60 (1.76) [2.26, 3.04]	4.66 (1.81) [4.16, 5.15]
	No	2.48 (1.71) [2.24, 2.72]	4.94 (1.80) [4.66, 5.28]
	<i>t</i> (<i>df</i>)	<i>t</i> (276) = 0.53, <i>p</i> = .30	<i>t</i> (180) = −0.95, <i>p</i> = .17
Heard advertisement on audio streaming service/radio	Yes	2.31 (1.65) [2.04, 2.59]	5.08 (1.71) [4.68, 5.47]
	No	2.69 (1.76) [2.39, 2.96]	4.72 (1.86) [4.36, 5.07]
	<i>t</i> (<i>df</i>)	<i>t</i> (276) = −1.83*	1.30 (180), <i>p</i> = .10
Heard Live Read	Yes	2.70 (1.82) [2.33, 3.04]	5.30 (1.56) [4.87, 5.65]
	No	2.41 (1.66) [2.16, 2.65]	4.62 (1.89) [4.28, 4.97]
	<i>t</i> (<i>df</i>)	1.34 (276), <i>p</i> = .09	2.47** (180)
Saw video of West Virginians explaining why they vaccinated	Yes	2.51 (1.70) [2.16, 2.88]	5.18 (1.74) [4.75, 5.58]
	No	2.51 (1.73) [2.27, 2.77]	4.68 (1.82) [4.35, 4.98]
	<i>t</i> (<i>df</i>)	−0.001 (276), <i>p</i> = .50	1.83* (180)
Saw billboard	Yes	2.55 (1.85) [2.10, 3.01]	5.13 (1.67) [4.64, 5.64]
	No	2.50 (1.68) [2.28, 2.74]	4.79 (1.84) [4.49, 5.08]
	<i>t</i> (<i>df</i>)	0.18 (276), <i>p</i> = .43	1.10 (180), <i>p</i> = .14
Healthcare Provider Recommended Vaccination	Yes	2.69 (1.89) [2.37, 3.00]	5.02 (1.73) [4.73, 5.32]
	No	2.36 (1.55) [2.13, 2.61]	4.39 (1.96) [3.82, 4.99]
	<i>t</i> (<i>df</i>)	1.54 (242.93), <i>p</i> = .06	2.04* (180)

* = *p* < .05, ** = *p* < .01, *** = *p* < .001

effectiveness of vaccination (i.e., response efficacy) and positive emotions toward choosing vaccination (i.e., affective attitude). For these variables, politically conservative participants and participants who identified as either Independent or Republican reported scores that were at the scale midpoint, representing ambivalence (e.g., “neither agree nor disagree”).

There were several deviations from these patterns of differences that are not reported in Tables 7 and 8. First, intention to choose vaccination was higher for those who reported being politically liberal, *M* = 3.05, *SD* = 2.08, 95 % *CI* [2.54, 3.56], compared to those who reported being politically conservative, *M* = 2.23, *SD* = 1.59, 95 % *CI* [1.91, 2.55], *F* (2, 275) = 3.78, *p* < .05, but neither differed from those who reported being politically moderate. The same kind of pattern was observed for political

Table 3

Comparison of COVID-19 risk perceptions across communication recall, with t-tests, means, standard deviations, and 95 % confidence intervals.

		Perceived Severity	Perceived Susceptibility	Negative Affect toward COVID-19
Saw advertisement on Internet	Yes	5.09 (1.78) [4.90, 5.29]	4.60 (1.51) [4.42, 4.76]	4.50 (1.82) [4.30, 4.7]
	No	5.18 (1.71) [5.02, 5.34]	4.44 (1.46) [4.30, 4.58]	4.26 (1.67) [4.10, 4.41]
	<i>t</i> (<i>df</i>)	−0.69 (754), <i>p</i> = .25	1.47 (754), <i>p</i> = .07	1.88*** (632.48)
Saw advertisement on TV	Yes	5.18 (1.74) [5.01, 5.33]	4.56 (1.52) [4.43, 4.70]	4.38 (1.78) [4.22, 4.55]
	No	5.09 (1.75) [4.87, 5.29]	4.40 (1.42) [4.24, 4.58]	4.32 (1.65) [4.12, 4.52]
	<i>t</i> (<i>df</i>)	0.72 (754), <i>p</i> = .24	1.44 (754), <i>p</i> = .08	0.45 (754), <i>p</i> = .32
Saw advertisement in local newspaper	Yes	5.23 (1.76) [5.01, 5.45]	4.62 (1.56) [4.42, 4.81]	4.41 (1.86) [4.18, 4.65]
	No	5.11 (1.73) [4.96, 5.26]	4.45 (1.44) [4.31, 4.57]	4.33 (1.67) [4.18, 4.48]
	<i>t</i> (<i>df</i>)	0.90 (754), <i>p</i> = .18	1.52 (754), <i>p</i> = .06	0.60 (754), <i>p</i> = .27
Heard advertisement on audio streaming service/radio	Yes	5.11 (1.74) [4.91, 5.30]	4.64 (1.49) [4.48, 4.80]	4.47 (1.77) [4.28, 4.66]
	No	5.17 (1.74) [5.01, 5.34]	4.40 (1.47) [4.26, 4.55]	4.27 (1.71) [4.10, 4.42]
	<i>t</i> (<i>df</i>)	−0.51 (754), <i>p</i> = .31	2.17** (754)	1.55 (754), <i>p</i> = .06
Heard Live Read	Yes	5.32 (1.72) [5.12, 5.50]	4.61 (1.47) [4.45, 4.78]	4.54 (1.72) [4.35, 4.73]
	No	5.02 (1.74) [4.86, 5.19]	4.43 (1.48) [4.28, 4.57]	4.23 (1.74) [4.06, 4.39]
	<i>t</i> (<i>df</i>)	2.28* (754)	1.70* (754)	2.42* (754)
Saw video of West Virginians explaining why they vaccinated	Yes	5.17 (1.77) [4.96, 5.39]	4.62 (1.53) [4.46, 4.79]	4.56 (1.69) [4.37, 4.77]
	No	5.13 (1.72) [4.97, 5.28]	4.43 (1.45) [4.30, 4.55]	4.23 (1.75) [4.08, 4.39]
	<i>t</i> (<i>df</i>)	0.31 (754), <i>p</i> = .38	1.68* (754)	2.56* (754)

(continued on next page)

Table 3 (continued)

		Perceived Severity	Perceived Susceptibility	Negative Affect toward COVID-19
Saw billboard	Yes	5.26 (1.68) [5.03, 5.47]	4.64 (1.56) [4.43, 4.87]	4.56 (1.72) [4.32, 4.79]
	No	5.10 (1.76) [4.95, 5.25]	4.45 (1.45) [4.33, 4.57]	4.28 (1.73) [4.14, 4.44]
	<i>t</i> (<i>df</i>)	1.11 (754), <i>p</i> = .13	1.59 (754), <i>p</i> = .06	1.96* (754)
Healthcare Provider Recommended Vaccination	Yes	5.36 (1.71) [5.21, 5.50]	4.62 (1.52) [4.49, 4.75]	4.58 (1.67) [4.44, 4.73]
	No	4.71 (1.73) [4.50, 4.92]	4.26 (1.38) [4.08, 4.42]	3.89 (1.78) [3.66, 4.11]
	<i>t</i> (<i>df</i>)	4.92*** (754)	3.15*** (754)	5.28*** (754)

* = $p < .05$, ** = $p < .01$, *** = $p < .001$

party identification, such that vaccination intention varied only between Democrat-identifying participants, $M = 3.07$, $SD = 1.87$, 95 % CI [2.62, 3.51], and Republican-identifying participants, $M = 2.18$, $SD = 1.50$, 95 % CI [1.90, 2.26], $F(2, 275) = 6.42$, $p < .05$. This was also the case for intention to receive a COVID-19 vaccine booster, such that Democrat-identifying participants reported stronger intention, $M = 5.36$, $SD = 1.86$, 95 % CI [4.84, 5.87], than those who identified as Republican, $M = 4.49$, $SD = 1.84$, 95 % CI [4.13, 4.86], $F(2, 179) = 4.20$, $p < .05$.

Each political orientation or party-identification then varied from each other for perceptions of COVID-19 severity and negative feelings toward COVID-19 (i.e., fear, worry). Perceptions of severity were highest for political liberals, $M = 5.74$, $SD = 1.56$, 95 % CI [5.49, 6.00], followed by political moderates, $M = 5.13$, $SD = 1.66$, 95 % CI [4.95, 5.32], and political conservatives, $M = 4.78$, $SD = 1.84$, 95 % CI [4.58, 4.99], $F(2, 753) = 16.69$, $p < .05$. Then, political liberals reported the strongest negative emotions toward COVID-19, $M = 5.05$, $SD = 1.48$, 95 % CI [4.80, 5.30], followed by political moderates, $M = 4.46$, $SD = 1.69$, 95 % CI [4.28, 4.65], and political conservatives, $M = 3.80$, $SD = 1.76$, 95 % CI [3.60, 4.00], $F(2, 753) = 30.295$, $p < .05$. Similarly, those who identified as Democrats rated the strongest negative emotions, $M = 4.91$, $SD = 1.49$, 95 % CI [4.70, 5.12], followed by Independents, $M = 4.41$, $SD = 1.74$, 95 % CI [4.15, 4.67], and Republicans, $M = 3.93$, $SD = 1.78$, 95 % CI [3.75, 4.11], $F(2, 753) = 24.53$, $p < .05$.

5.2.1. Interactions between politics and communication

To continue evaluating the possible role of politics in the vaccination communication campaign, either political dimension was included in a series of two-way ANOVAs with each communication outcome. A statistically significant interaction effect would suggest that either political ideology or political party identification conditioned possible influences of vaccination communication outcomes on vaccination-related beliefs; or, in other words, if the association between vaccination-related beliefs and recall of vaccination communication depended on participants' political beliefs.

Table 9a shows statistically significant interactions between political ideology and recall of Internet vaccination advertisements and Table 9b shows statistically significant interactions between political ideology and recall of radio live reads about vaccination. Generally speaking, recall of Internet advertisements was associated with stronger beliefs especially for politically liberal participants while politically moderate or conservative participants had either no difference based on recall or

Table 4

Comparison of vaccination efficacy beliefs across communication recall, with *t*-tests, means, standard deviations, and 95 % confidence intervals.

		Perceived Behavioral Control	Vaccination Self-Efficacy	Response Efficacy
Saw advertisement on Internet	Yes	5.71 (1.41) [5.55, 5.87]	5.36 (1.57) [5.05, 5.64]	4.54 (1.99) [4.35, 4.76]
	No	5.66 (1.33) [5.53, 5.77]	4.97 (1.67) [4.70, 5.22]	4.55 (1.93) [4.37, 4.73]
	<i>t</i> (<i>df</i>)	0.57 (754), <i>p</i> = .29	1.96* (754)	−0.02 (754), <i>p</i> = .49
Saw advertisement on TV	Yes	5.77 (1.35) [5.64, 5.89]	5.24 (1.61) [4.99, 5.49]	4.58 (1.98) [4.39, 4.75]
	No	5.54 (1.38) [5.37, 5.70]	4.96 (1.68) [4.63, 5.26]	4.49 (1.90) [4.27, 4.72]
	<i>t</i> (<i>df</i>)	2.20** (754)	1.45 (276), <i>p</i> = .07	0.56 (754), <i>p</i> = .29
Saw advertisement in local newspaper	Yes	5.77 (1.37) [5.58, 5.93]	5.26 (1.69) [4.88, 5.62]	4.69 (2.03) [4.43, 4.94]
	No	5.64 (1.36) [5.52, 5.76]	5.06 (1.63) [4.83, 5.30]	4.48 (1.91) [4.30, 4.64]
	<i>t</i> (<i>df</i>)	1.25 (754), <i>p</i> = .11	0.91 (276), <i>p</i> = .18	1.42 (754), <i>p</i> = .08
Heard advertisement on audio streaming service/radio	Yes	5.69 (1.39) [5.53, 5.83]	5.20 (1.67) [4.92, 5.50]	4.46 (2.00) [4.24, 4.69]
	No	5.68 (1.34) [5.55, 5.79]	5.04 (1.63) [4.78, 5.33]	4.61 (1.91) [4.42, 4.78]
	<i>t</i> (<i>df</i>)	0.12 (754), <i>p</i> = .45	0.81 (276), <i>p</i> = .21	−1.01 (754), <i>p</i> = .16
Heard Live Read	Yes	5.80 (1.34) [5.64, 5.95]	5.35 (1.64) [5.02, 5.66]	4.85 (1.83) [4.66, 5.06]
	No	5.60 (1.38) [5.46, 5.74]	4.99 (1.64) [4.73, 5.24]	4.32 (2.01) [4.14, 4.51]
	<i>t</i> (<i>df</i>)	1.99* (754)	1.73* (276)	3.79* (714.88)
Saw video of West Virginians explaining why they vaccinated	Yes	5.67 (1.44) [5.50, 5.83]	5.10 (1.71) [4.72, 5.44]	4.65 (1.92) [4.44, 4.88]
	No	5.69 (1.31) [5.57, 5.81]	5.13 (1.61) [4.89, 5.39]	4.48 (1.97) [4.30, 4.65]
	<i>t</i> (<i>df</i>)	−0.23 (754), <i>p</i> = .41	−0.16 (276), <i>p</i> = .44	1.14 (754), <i>p</i> = .13

(continued on next page)

Table 4 (continued)

		Perceived Behavioral Control	Vaccination Self-Efficacy	Response Efficacy
Saw billboard	Yes	5.71 (1.44) [5.50, 5.90]	5.41 (1.69) [4.99, 5.82]	4.77 (1.98) [4.47, 5.03]
	No	5.67 (1.34) [5.56, 5.79]	5.03 (1.62) [4.80, 5.23]	4.46 (1.93) [4.30, 4.63]
	<i>t</i> (df)	0.30 (754), <i>p</i> = .38	1.63* (276)	1.91* (754)
Healthcare Provider Recommended Vaccination	Yes	5.82 (1.33) [5.70, 5.93]	5.42 (1.53) [5.15, 5.67]	4.97 (1.83) [4.81, 5.13]
	No	5.39 (1.38) [5.21, 5.57]	4.87 (1.70) [4.59, 5.13]	3.67 (1.90) [3.44, 3.91]
	<i>t</i> (df)	4.15*** (754)	2.81*** (276)	8.94*** (474.50)

* = $p < .05$, ** = $p < .01$, *** = $p < .001$

had a smaller magnitude of difference. For live reads, differences were only observed for social norms and perceived behavioral control. In this case, politically moderate respondents particularly reported stronger control over vaccination when they had recalled hearing a live read, while politically liberal and politically conservative participants did not vary based on recall.

5.3. Social vulnerability

Finally, to examine differences in vaccination beliefs by the regions' social vulnerability, a series of one-way ANOVAs were conducted to compare beliefs across the SVI levels. The only case in which variance was observed was for the belief that others were vaccinating (i.e., descriptive norm), such that the descriptive norm was strongest in the region with SVI between 0.0 and 0.25, $M = 5.32$, $SD = 1.46$, 95 % CI [5.00, 5.65], followed by 0.7500001–1.0, $M = 4.94$, $SD = 1.79$, 95 % CI [4.71, 5.10], then 0.5000001 to 0.75, $M = 4.90$, $SD = 1.76$, 95 % CI [4.41, 4.99], and finally 0.2500001 to 0.50, $M = 4.70$, $SD = 1.73$, 95 % CI [5.00, 5.65], $F(3, 752) = 2.75$, $p < .05$. SVI was then also included as a factor in a series of two-way ANOVAs with each communication outcome to explore possible interactions. No statistically significant interactions were observed and thus no suggestions of conditional associations between vaccination beliefs and communication outcomes.

6. Discussion

Overall, this sample—which has a spread of political ideologies and orientations, ages, and regions of the state represented—had relatively supportive beliefs related to choosing vaccination against the virus that causes COVID-19, albeit to different degrees based on subgroups. Inspecting the mean scores across every belief and between every group breakdown shows, outside of intention to choose vaccination, that the social landscape was at least conducive to vaccination communication, generally, and with specific considerations that need to be taken when communicating publicly and privately [3,4].

These data provide evidence of the effectiveness of campaign-specific and more general vaccination communication. Robust formative research with consistent process evaluation, such as these data, suggest that this vaccination communication campaign has built confidence in choosing vaccination, at least in part. Recall of vaccination communication, much of which was directly related to the statewide campaign, largely showed differences across important psychosocial

Table 5

Comparison of vaccination attitudes across communication recall, with t-tests, means, standard deviations, and 95 % confidence intervals.

		Instrumental Attitude	Affective Attitude
Saw advertisement on Internet	Yes	4.76 (1.89) [4.55, 4.97]	4.44 (1.88) [4.22, 4.67]
	No	4.76 (1.79) [4.59, 4.92]	4.48 (1.70) [4.33, 4.65]
	<i>t</i> (df)	0.04 (754), <i>p</i> = .48	−0.28 (754), <i>p</i> = .39
Saw advertisement on TV	Yes	4.84 (1.86) [4.68, 5.01]	4.50 (1.84) [4.32, 4.68]
	No	4.62 (1.78) [4.42, 4.83]	4.40 (1.65) [4.22, 4.60]
	<i>t</i> (df)	1.57 (754), <i>p</i> = .06	0.75 (754), <i>p</i> = .23
Saw advertisement in local newspaper	Yes	4.91 (1.88) [4.68, 5.15]	4.55 (1.84) [4.32, 4.76]
	No	4.69 (1.80) [4.51, 4.85]	4.43 (1.74) [4.26, 4.58]
	<i>t</i> (df)	1.55 (754), <i>p</i> = .06	0.88 (754), <i>p</i> = .19
Heard advertisement on audio streaming service/radio	Yes	4.67 (1.86) [4.48, 4.85]	4.39 (1.88) [4.18, 4.61]
	No	4.83 (1.80) [4.66, 5.00]	4.52 (1.69) [4.37, 4.69]
	<i>t</i> (df)	−1.20 (754), <i>p</i> = .12	−1.07 (754), <i>p</i> = .14
Heard Live Read	Yes	5.03 (1.75) [4.86, 5.23]	4.74 (1.72) [4.55, 4.94]
	No	4.56 (1.86) [4.38, 4.74]	4.27 (1.79) [4.10, 4.43]
	<i>t</i> (df)	3.50*** (754)	3.64*** (754)
Saw video of West Virginians explaining why they vaccinated	Yes	4.80 (1.87) [4.58, 5.02]	4.56 (1.82) [4.35, 4.76]
	No	4.74 (1.80) [4.57, 4.92]	4.41 (1.74) [4.25, 4.56]
	<i>t</i> (df)	0.42 (754), <i>p</i> = .34	1.13 (754), <i>p</i> = .13
Saw billboard	Yes	4.94 (1.86) [4.70, 5.21]	4.65 (1.79) [4.41, 4.86]
	No	4.69 (1.81) [4.53, 4.83]	4.40 (1.76) [4.25, 4.54]
	<i>t</i> (df)	1.70* (754)	1.76** (754)
Healthcare Provider Recommended Vaccination	Yes	5.14 (1.73) [5.00, 5.28]	4.81 (1.72) [4.66, 4.96]
	No	3.98 (1.79) [3.75, 4.19]	3.76 (1.67) [3.56, 3.96]
	<i>t</i> (df)	8.60*** (754)	8.01*** (754)

* = $p < .05$, ** = $p < .01$, *** = $p < .001$

predictors of vaccination behavior. In particular, having a recommendation to get vaccinated against COVID-19 from a healthcare provider (which substantial effort within the communication campaign was dedicated toward supporting, given the team's previous findings on the strength of trust in healthcare providers as messengers), recall of a “live read” in which popular radio personalities read scripted vaccination-related messages, and having visited the state vaccination website all showed strong and consistent differences in relevant beliefs. Furthermore, subjective norms (i.e., believing that people important to me think I should get vaccinated against COVID-19) and descriptive norms (i.e., believing that people important to me are choosing or have chosen get vaccination against the virus that causes COVID-19) were stronger for recall of every measured communication outcome. Then, in every case

Table 6
Comparison of vaccination social norms across communication recall, with t-tests, means, standard deviations, and 95 % confidence intervals.

		Descriptive Norm	Subjective Norm
Saw advertisement on Internet	Yes	5.16 (1.73) [4.98, 5.35]	5.11 (1.68) [4.90, 5.30]
	No	4.78 (1.71) [4.61, 4.93]	4.58 (1.75) [4.41, 4.74]
	<i>t</i> (df)	3.03*** (754)	4.18*** (754)
Saw advertisement on TV	Yes	5.06 (1.73) [4.91, 5.21]	4.94 (1.74) [4.77, 5.09]
	No	4.73 (1.71) [4.53, 4.93]	4.57 (1.73) [4.35, 4.77]
	<i>t</i> (df)	2.54** (754)	2.82** (754)
Saw advertisement in local newspaper	Yes	5.18 (1.70) [4.97, 5.37]	5.16 (1.65) [4.96, 5.36]
	No	4.81 (1.73) [4.66, 4.97]	4.62 (1.76) [4.46, 4.78]
	<i>t</i> (df)	2.76** (754)	4.03*** (754)
Heard advertisement on audio streaming service/radio	Yes	5.07 (1.69) [4.88, 5.27]	4.94 (1.75) [4.76, 5.12]
	No	4.83 (1.73) [4.67, 5.00]	4.69 (1.73) [4.53, 4.87]
	<i>t</i> (df)	1.87* (754)	1.93* (754)
Heard Live Read	Yes	5.21 (1.62) [5.03, 5.39]	5.16 (1.59) [4.98, 5.33]
	No	4.74 (1.78) [4.57, 4.90]	4.54 (1.81) [4.38, 4.71]
	<i>t</i> (df)	3.82*** (714.31)	4.98*** (725.71)
Saw video of West Virginians explaining why they vaccinated	Yes	5.30 (1.63) [5.11, 5.48]	5.09 (1.69) [4.89, 5.29]
	No	4.71 (1.75) [4.55, 4.87]	4.62 (1.75) [4.45, 4.77]
	<i>t</i> (df)	4.66*** (641.84)	3.69*** (754)
Saw billboard	Yes	5.20 (1.69) [4.97, 5.45]	5.21 (1.65) [4.98, 5.44]
	No	4.84 (1.73) [4.68, 4.98]	4.64 (1.75) [4.49, 4.78]
	<i>t</i> (df)	0.62*** (754)	4.02*** (754)
Healthcare Provider Recommended Vaccination	Yes	5.29 (1.60) [5.14, 5.43]	5.23 (1.58) [5.09, 5.36]
	No	4.20 (1.74) [3.98, 4.40]	3.92 (1.74) [3.71, 4.13]
	<i>t</i> (df)	8.53** (754)	10.31*** (754)

* = *p* < .05, ** = *p* < .01, *** = *p* < .001.

other than unvaccinated participants' vaccination intention, reporting that a healthcare provider had recommended that they choose vaccination was associated with strongly vaccination-related beliefs. Perceptions of COVID-19 susceptibility, or the believed likelihood of getting COVID-19, nearly never varied by communication recall. However, this is not surprising as prior data informed decisions early in the campaign *not* to focus messages explicitly about COVID-19 risk and instead prioritize providing information tailored toward building confidence in the safety and effectiveness of vaccination and in identifying where, when, and for whom vaccination was available.

These data support the idea that having trusted voices, such as popular local personalities and healthcare providers, can help to create a supportive information environment, which is further evidenced in the

Table 7
Statistically significant differences by political ideology, per Analysis of Variance.

	Liberal	Moderate or Conservative	<i>F</i> (df)
Booster Intention	5.73 (1.69) [5.13, 6.32]	M: 4.83 (1.66) [4.46, 5.20] C: 4.45 (1.92) [4.01, 4.89]	5.85 (2, 179)
Response Efficacy	5.51 (1.80) [5.23, 5.80]	M: 4.31 (1.80) [4.10, 4.52] C: 4.21 (2.01) [3.99, 4.43]	29.51 (2, 753)
Instrumental Attitude	5.52 (1.92) [5.25, 5.79]	M: 4.61 (1.68) [4.42, 4.81] C: 4.45 (1.80) [4.24, 4.66]	20.88 (2, 753)
Affective Attitude	5.31 (1.67) [5.05, 5.56]	M: 4.34 (1.68) [4.15, 4.53] C: 4.08 (1.78) [3.88, 4.29]	28.30 (2, 753)
Descriptive Norm	5.54 (1.67) [5.28, 5.79]	M: 4.78 (1.68) [4.59, 4.97] C: 4.74 (1.73) [4.53, 4.94]	13.86 (2, 753)
Subjective Norm	5.48 (1.64) [5.23, 5.74]	M: 4.60 (1.72) [4.41, 4.79] C: 4.60 (1.73) [4.40, 4.80]	17.85 (2, 753)
Note: Those who reported being politically moderate and conservative did not vary from one another in these cases, but both did vary from those who reported being politically liberal.			

Table 8
Statistically significant differences by political party identification, per Analysis of Variance.

	Democrat	Independent or Republican	<i>F</i> (df)
Severity	5.70 (1.55) [5.49, 5.92]	I: 5.01 (1.79) [4.75, 5.27] R: 4.81 (1.75) [4.63, 4.99]	15.72 (2, 753)
Perceived Behavioral Control	6.04 (1.23) [5.87, 6.20]	I: 5.42 (1.40) [5.22, 5.63] R: 5.55 (1.39) [5.41, 5.69]	13.22 (2, 753)
Response Efficacy	5.53 (1.66) [5.30, 5.75]	I: 4.20 (1.88) [3.91, 4.48] R: 4.01 (1.92) [3.82, 4.20]	53.30 (2, 753)
Instrumental Attitude	5.64 (1.63) [5.42, 5.86]	I: 4.42 (1.71) [4.15, 4.68] R: 4.29 (1.79) [4.11, 4.47]	48.12 (2, 753)
Affective Attitude	5.38 (1.51) [5.18, 5.59]	I: 4.06 (1.72) [3.81, 4.32] R: 4.00 (1.72) [3.82, 4.18]	56.30 (2, 753)
Descriptive Norm	5.62 (1.47) [5.41, 5.82]	I: 4.85 (1.52) [4.59, 5.10] R: 4.49 (1.84) [4.32, 4.67]	33.52 (2, 753)
Subjective Norm	5.49 (1.46) [5.28, 5.70]	I: 4.51 (1.78) [4.26, 4.77] R: 4.43 (1.77) [4.26, 4.61]	31.74 (2, 753)

Note: Those who identified as Republican or Independent did not vary from one another in these cases, but both did vary from those who identified as Democrat.

consistency of differences in social norms by communication variables. This reflects our ongoing observation of the importance of social norms in statistically predicting vaccination outcomes (e.g., [3,4,12]) and suggests the importance of continued empathetic and approachable communication strategies that can continue to shift the normative

Table 9a

Analysis of variance results for statistically significant interactions between Political Ideology and recall of a COVID-19 vaccination advertisement on the Internet from the state Department of Health, by psychosocial outcome.

	Did Not See or Not Sure M (SD) [95 % CI]	Saw M (SD) [95 % CI]	F (df)
Perceived Severity			
Liberal	5.71 (1.61) [5.37, 6.03]	5.79 (1.51) [5.45, 6.09]	5.15 (2, 750)
Moderate	5.05 (1.64) [4.80, 5.29]	5.26 (1.68) [4.98, 5.54]	
Conservative	5.04 (1.80) [4.77, 5.31]	4.37 (1.84) [4.04, 4.72]	
Negative Affect			
Liberal	4.83 (1.54) [4.47, 5.16]	5.30 (1.38) [4.99, 5.61]	3.50 (2, 750)
Moderate	4.30 (1.63) [4.07, 4.53]	4.70 (1.75) [4.40, 5.00]	
Conservative	3.90 (1.69) [3.67, 4.15]	3.65 (1.86) [3.25, 4.01]	
Descriptive Norms			
Liberal	5.38 (1.76) [4.99, 5.73]	5.71 (1.55) [5.33, 6.03]	3.17 (2, 750)
Moderate	4.50 (1.66) [4.25, 4.74]	5.19 (1.64) [4.88, 5.48]	
Conservative	4.75 (1.67) [4.49, 4.99]	4.71 (1.84) [4.36, 5.06]	
Subjective Norms			
Liberal	5.31 (1.75) [4.91, 5.67]	5.68 (1.48) [5.36, 5.97]	2.92 (2, 750)
Moderate	4.26 (1.71) [3.97, 4.50]	5.09 (1.63) [4.80, 5.39]	
Conservative	4.54 (1.70) [4.27, 4.79]	4.70 (1.77) [4.39, 5.05]	
Perceived Behavioral Control			
Liberal	5.94 (1.20) [5.65, 6.16]	5.86 (1.59) [5.49, 6.21]	4.16 (2, 750)
Moderate	5.37 (1.39) [5.18, 5.56]	5.76 (1.34) [5.50, 5.97]	
Conservative	5.82 (1.28) [5.63, 6.01]	5.56 (1.35) [5.30, 5.81]	
Affective Attitude			
Liberal	5.373 (1.63) [5.04, 5.69]	5.23 (1.71) [4.86, 5.57]	6.65 (2, 750)
Moderate	4.176 (1.61) [3.95, 4.41]	4.58 (1.75) [4.27, 4.88]	
Conservative	4.331 (1.67) [4.07, 4.59]	3.68 (1.89) [3.31, 4.05]	
Response Efficacy			
Liberal	5.54 (1.86) [5.16, 5.93]	5.49 (1.75) [5.10, 5.88]	4.23 (2, 750)
Moderate	4.17 (1.79) [3.91, 4.44]	4.52 (1.80) [4.21, 4.85]	
Conservative	4.43 (1.93) [4.12, 4.72]	3.86 (2.10) [3.43, 4.26]	

landscape. While causality cannot be inferred due to the nature of these cross-sectional data, nonetheless this builds on other evidence from other campaign partners (e.g., [5]) demonstrating the importance of having consistent communication strategies that are responsive to the views and needs of the population.

Outside of campaign communication, partisan differences in vaccination-related beliefs were observed to various extents. However, these instances were not necessarily what might be expected. It was indeed seen that participants who identified as Republican or Conservative reported weaker beliefs than those who identified as Democratic or Liberal, respectively. However, Republican and Conservative

Table 9b

Analysis of variance results for statistically significant interactions between Political Ideology and recall of a COVID-19 vaccination live read, by psychosocial outcome.

	Did Not Hear or Not Sure M (SD) [95 % CI]	Heard M (SD) [95 % CI]	<i>F</i> (<i>df</i>)
Descriptive Norms			
Liberal	5.46 (1.81) [5.08, 5.81]	5.66 (1.43) [5.27, 5.99]	3.69 (2, 750)
Moderate	4.41 (1.68) [4.15, 4.65]	5.31 (1.54) [5.06, 5.59]	
Conservative	4.64 (1.74) [4.33, 4.92]	4.86 (1.73) [4.56, 5.16]	
Subjective Norms			
Liberal	5.30 (1.75) [4.95, 5.63]	5.76 (1.41) [5.39, 6.10]	2.98 (2, 750)
Moderate	4.19 (1.74) [3.91, 4.45]	5.19 (1.52) [4.90, 5.45]	
Conservative	4.44 (1.78) [4.14, 4.72]	4.79 (1.65) [4.51, 5.07]	
Perceived Behavioral Control			
Liberal	5.92 (1.32) [5.68, 6.15]	5.87 (1.50) [5.50, 6.21]	5.95 (2, 750)
Moderate	5.28 (1.44) [5.09, 5.47]	5.89 (1.21) [5.66, 6.09]	
Conservative	5.76 (1.28) [5.55, 5.96]	5.66 (1.36) [5.41, 5.90]	

participants, by and large, still had average scores above the scale midpoints on numerous variables. For example, while Democrats may perceive COVID-19 as more serious than both Independents and Republicans, the latter two groups still on average perceived COVID-19 as being severe; Republicans and Independents more weakly endorsed—but still endorsed—the idea that COVID-19 was a serious disease, compared to Democrats.

These findings provide a more complicated picture than the current prevailing wisdom that politically conservative members of the public, as well as those who identify with the Republican Party generally, are opposed to vaccination while those who are politically liberal and/or identify with the Democratic Party are supportive of vaccination. Instead, what we see is that they may just vary in the strength of their beliefs and have other nuanced criteria for their decision-making. It might also be that politically conservative members of the public do not as consistently reject vaccination-related information as might be presumed, or even that politically liberal members of the public do not always as strongly outright support vaccination-related information.

Even when taking both partisanship and communication recall together, any interaction effects still suggested differences that are not necessarily of concern to public health messengers. While there may be instances in which Republicans or Conservatives have relatively weaker beliefs around vaccination, they were not *negative* beliefs. Communication can and should be crafted to still improve those beliefs and move toward positions that are conducive to vaccination, but they do not seem to be negatively impacting vaccination in these data.

Social norms continue to be unique in COVID-19 vaccination, at least in WV, being consistent predictors of vaccination plans and behavior (e.g., [3,4,12]). Both kinds of social norms were stronger for Democrats/Liberals compared to Republicans/Conservatives, but the latter groups still reported positive normative beliefs. Communication about vaccination seems to be positively associated with social norms regardless of political views/identification, so long as that communication is sensitive to the populations' beliefs and reservations around choosing vaccination against the virus that causes COVID-19. The communication campaign that this project is a part of has been consistently focused on messaging to avoid anger and resistance from the general population, and that may

be a factor in why recall of the communication outcomes did not show differences wherein partisans were vastly different.

7. Conclusion

This study's findings build on theory-driven prior work informing and evaluating ongoing communication efforts to support the public's choosing vaccination to against the virus that causes COVID-19 in a highly rural and Republican/conservative Appalachian state. This work offers novel insights into the complexities of COVID-19 vaccination beliefs, especially as they relate to respondents' political and ideological identification, social vulnerability index score, and aided recall of public health communication campaign efforts in the state.

Findings revealed that despite varying strength of beliefs across political groups, there was a broad general openness to choosing vaccination against the virus that causes COVID-19, which reflects a social landscape conducive to vaccination communication and points toward the importance of understanding unique population segment needs, wants, and reservations, as well as the messengers from whom they trust to receive such information. For example, this study highlights the critical role of trusted voices, such as healthcare providers and local media personalities, in fostering positive social norms that promote vaccination behavior. These trusted figures may be particularly influential in shaping beliefs, as evidenced by differences in communication recall and psychosocial predictors of vaccination behavior, although interpretations here are limited by the cross-sectional survey design.

It is worth noting that partisanship played a role surrounding vaccination-related beliefs; however, even politically conservative groups, often presumed as less supportive of choosing vaccination against the virus that causes COVID-19, still exhibited positive attitudes and intentions toward vaccination (above the measurement scale mid-points) – albeit to a lesser degree than their liberal counterparts. This finding challenges the prevailing narrative that conservative individuals uniformly reject vaccination and suggests a more nuanced understanding of how political ideology interacts with health behavior.

The consistency of social norms as predictors of choosing vaccination observed in this study's data along with prior work further underscores the need for continued empathetic and non-polarizing public health communication. While these cross-sectional data cannot establish causality, they reinforce the practical importance of responsive and sensitive communication that addresses the diverse needs and concerns of the population.

Ultimately, this study underscores the value of tailored and trusted communication strategies in bolstering positive vaccination beliefs and behavior, regardless of political affiliation. Future efforts should continue to use sophisticated communication science and public health data collections to inform communication campaign efforts that focus on tailored messaging, creating a supportive information ecosystem, leveraging trusted messengers, and avoiding divisive messaging to maintain and enhance public confidence in vaccination efforts.

CRedit authorship contribution statement

Dan Totzkay: Writing – review & editing, Writing – original draft,

Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Julia Daisy Fraustino:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Lisa M. Costello:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Conceptualization. **Traci Jarrett:** Investigation, Funding acquisition, Conceptualization. **Alfgeir L. Kristjansson:** Investigation, Funding acquisition, Conceptualization.

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.

Data availability

The data that has been used is confidential.

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