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Designing and testing social media campaign messages to promote COVID-19 vaccine confidence among rural adults: A community-engaged approach featuring rural community leader and clinician testimonials

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ABSTRACT

Despite the growing availability of effective COVID-19 vaccines in rural communities in the United States, widespread vaccine hesitancy delays COVID-19 vaccine coverage in rural communities and threatens to worsen pre-pandemic rural–urban disparities in other vaccination rates, including influenza and routine pediatric immunizations. Therefore, there is an urgent need to develop communication-based interventions to improve vaccine confidence in rural America. This study demonstrates the efficacy of a community-engaged approach to developing social media campaign messages in promoting COVID-19 vaccine uptake and pro-vaccine social diffusion among rural adults. Using a community-engaged approach, we developed social media campaign videos varying in (a) featured messengers (clinicians versus community leaders) and (b) the presence of personal testimonials. We conducted a national online experiment ($N = 1{,}364$ rural adults) in spring 2022. We found that videos featuring clinicians serving rural communities and their testimonials increased (a) vaccination intentions in the unvaccinated group (4-point scale, $b = 0.23$, $p = .015$) and (b) intention to discuss the messages with others (4-point scale, $b = 0.14$, $p = .037$), share the message (4-point scale, $b = 0.15$, $p = .026$), and promote the vaccines to others (9-point scale, $b = 0.48$, $p = .013$). Results suggest that vaccine promotional social media campaigns targeting rural populations can benefit from including clinician testimonials.

1. Introduction

Despite the growing availability of effective COVID-19 vaccines in rural communities in the United States, the rural–urban gap in COVID-19 vaccine primary series completion widened between 2021 and January 2022. (Khubchandani et al., 2021; Sun and Monnat, 0000) The vaccine hesitancy gap also threatens to worsen pre-pandemic rural–urban disparities in other vaccination rates including influenza vaccination and routine pediatric immunizations. (Jain et al., 2022; Albers et al., 2022) Given that rural America already faces more restricted access to healthcare resources and a widening gap in a range of health outcomes, (Agency for Healthcare Research and Quality., 2017) there is an urgent need to develop communication-based interventions to improve vaccine confidence in rural America.

Nationally, the trend towards using social media to gather health information, including communicating with healthcare professionals, was on the rise even before the pandemic. (Huo et al., 2013) Unfortunately, the combination of automated bot accounts, recommendation algorithms, and an active and vocal cluster of anti-vaccine advocacy groups has given rise to rapidly growing discourses of vaccine refusal on Meta/Facebook public pages, X/Twitter, TikTok, and YouTube. (Ginossar et al., 2022; Broniatowski et al., 2018) Many of the active anti-

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vaccine advocacy accounts disseminate groundless misinformation while traversing between platforms to create illusions of scientific consensus and majority opinions regarding vaccine safety and efficacy. (Ginossar et al., 2022; Broniatowski et al., 2018) During the pandemic, both higher social media use (Ruiz and Bell, 2021) and geographically aggregated presence of social media misinformation about COVID-19 (Pierri et al., 2022) predicted lower vaccination intentions and uptake rates.

As feelings of distrust of government and urban centers continue to escalate, (Cramer, 2016; Tram et al., 2019) clinicians serving rural communities remain one of the most trusted sources of health information among rural residents. (Reiter et al., 2020; Head et al., 2020) Clinicians are viewed as the most reliable and trustworthy source of health information in the U.S. in general. (Jackson et al., 2019) In the context of COVID-19, trusted clinicians' vaccine recommendation is a key determinant of vaccine acceptability. (Reiter et al., 2020) Frontline clinicians were the first to receive the COVID-19 vaccine in the U.S., positioning them to be sources of firsthand information about COVID-19 vaccines. (Katzman and Katzman, 2021) Thus, they might have the best chance of promoting vaccines to their own patients. Systematic research is needed to identify effective strategies to empower trusted local clinicians to become persuasive online "influencers" (Oehler, 2020) for vaccine promotion through social media campaigns.

In the Communities Confront COVID (C3) social media campaign, we took a community-engaged approach to identifying trusted champions who support COVID-19 vaccines and have standing in the specific rural community we targeted. Thus, we borrow on the social capital and network of individual champions who can directly relate to the social, economic, political, and historical context of the community and can, therefore, create trusted connections with others. (Miech et al., 2018) The C3 campaign collaborated with a community partner, the Southwestern Wisconsin Community Action Program, to identify two types of community champions in southwestern Wisconsin: (a) clinicians serving rural counties and (b) local community leaders (e.g., pastors, local business owners, radio station hosts). We then developed COVID-19 vaccine promotion public service announcements (PSAs) featuring our champions' personal testimonials, in our context defined as narratives of the champion's experiences during the pandemic with voices advocating for COVID-19 vaccines. We focused on personal testimonials because they can motivate health behavior changes beyond belief updating, (Kreuter et al., 2007; Kim et al., 2012) including producing emotional responses (Oehler, 2020) known to increase message retransmission. (Berger and Milkman, 2012; Chen and Dredze, 2018) We chose clinicians and community leaders as both are trusted voices in the community. That said, expertise is a well-established dimension of source credibility in the persuasion literature. (Birnbaum and Stegner, 1979; Eastin, 2001) Given that clinicians are perceived to have higher medical expertise, we expect PSAs featuring clinicians to be more effective than those featuring local community leaders in promoting COVID-19 vaccines.

Our approach targets two behavioral outcomes: message recipients' (a) vaccine acceptance and (b) social diffusion of pro-vaccine messages (e.g., discussing and/or sharing the messages with others). A communication campaign can produce population-level impacts via social diffusion beyond relying exclusively on intrapersonal persuasion. (Hornik, 2002) Diffusion plays an important role on social media specifically because overall campaign reach online is a function of algorithmic recommendation and accumulated shares along the message's diffusion chain, both of which hinge upon each message recipient's likelihood to retransmit the message. (Cappella et al., 2014) Furthermore, when a message recipient is motivated to speak up and advocate for vaccines, their influence on their hesitant close contacts can counteract the negative impacts of exposure to anti-vaccine messaging. (Chan et al., 2020) Although prior research (Borah et al., 2021; Santos et al., 2021; Ye et al., 2021) has identified several promising message features to improve COVID-19 vaccine promotion (e.g., emphasizing health benefits to self, health risks, pro-vaccine social norms), it remains largely unknown whether personal testimonials from clinicians can outperform community leaders or non-testimonial clinician messages for these two outcomes mentioned above. Our study fills this gap.

In this report, we present evidence from a randomized online experiment conducted with a national sample of rural residents. Our findings highlight the effectiveness of the C3 social media campaign in enhancing the persuasiveness of trusted vaccine champions who serve rural communities. Our approach incorporates several unique components from the fields of public health and health communication: (a) featuring trusted clinicians and community leaders as the key messenger, (b) deploying personal testimonials to enhance messages' capacity to activate both the intrapersonal (the message recipient's own vaccine acceptance) and the social route (sharing messages and promoting vaccines to others) for campaign effectiveness, and (c) adopting a community-engaged approach to partner with local healthcare systems for message co-design, campaign dissemination, and evaluation.

2. Methods

2.1. Participants

Participants in the national online experiment were U.S. adults living in areas with a rural–urban commuting area (RUCA) code greater than or equal to 4. The online experiment was fielded in spring 2022 through the survey company Lucid. Of the initial 3,123 contacted panelists, 589 did not meet eligibility criteria, 299 dropped out before completion, and 717 were excluded due to full survey quota on sex and COVID-19 vaccination status. Additionally, 164 participants were randomly assigned to the baseline condition where no PSA videos were shown and were excluded from further analysis, because the current report focused on comparing PSA conditions. For more details on attrition and quota-full exclusion, see the CONSORT form in Fig. 1.

In the analytical sample ($N = 1{,}364$), participants' characteristics did not differ across conditions (Table 1), were aged 48.5 years on average ($SD = 16.9$) and were mostly identified as White (90.5 %). More than half had college or higher education (60.2 %), were identified as women (56.4 %), and were vaccinated with at least one dose of COVID-19 vaccines (54.0 %). Unvaccinated participants accounted for 45.4 % of the sample.

2.2. Experimental design and message stimuli

We adopted a double-control randomized design to identify the effects of (a) deploying testimonials as a persuasive content feature and (b) featuring clinicians who serve rural communities as messengers. All C3 PSAs featured either clinicians or community leaders as messengers and presented some form of personal testimonial related to COVID-19 vaccines (e.g., personal experiences with COVID-19 vaccines, stories of taking care of unvaccinated patients suffering from COVID-19 illness). Links to all stimuli videos are available in Appendix B.

We selected vaccine-promoting PSAs from Wisconsin Department of Health Services' statewide "Our Doctors" multimedia campaign as the first group of control messages. These PSAs featured general COVID-19 vaccine endorsement from clinicians in Wisconsin, but without testimonials describing their personal experiences about the pandemic and/or vaccination. By comparing C3 PSAs featuring testimonials from clinicians with "Our Doctors" PSAs, we were able to isolate the incremental effect of personal testimonials as a persuasive strategy while keeping the "messenger" factor comparable.

We treat C3 PSAs featuring community leaders and their personal testimonials as the second group of control messages. By comparing C3 clinician PSAs with C3 community leader PSAs, we can estimate the "messenger" effect attributable to clinicians while keeping the persuasive strategy of deploying personal testimonials constant.

The PSA pool consisted of 24 short videos promoting the COVID-19

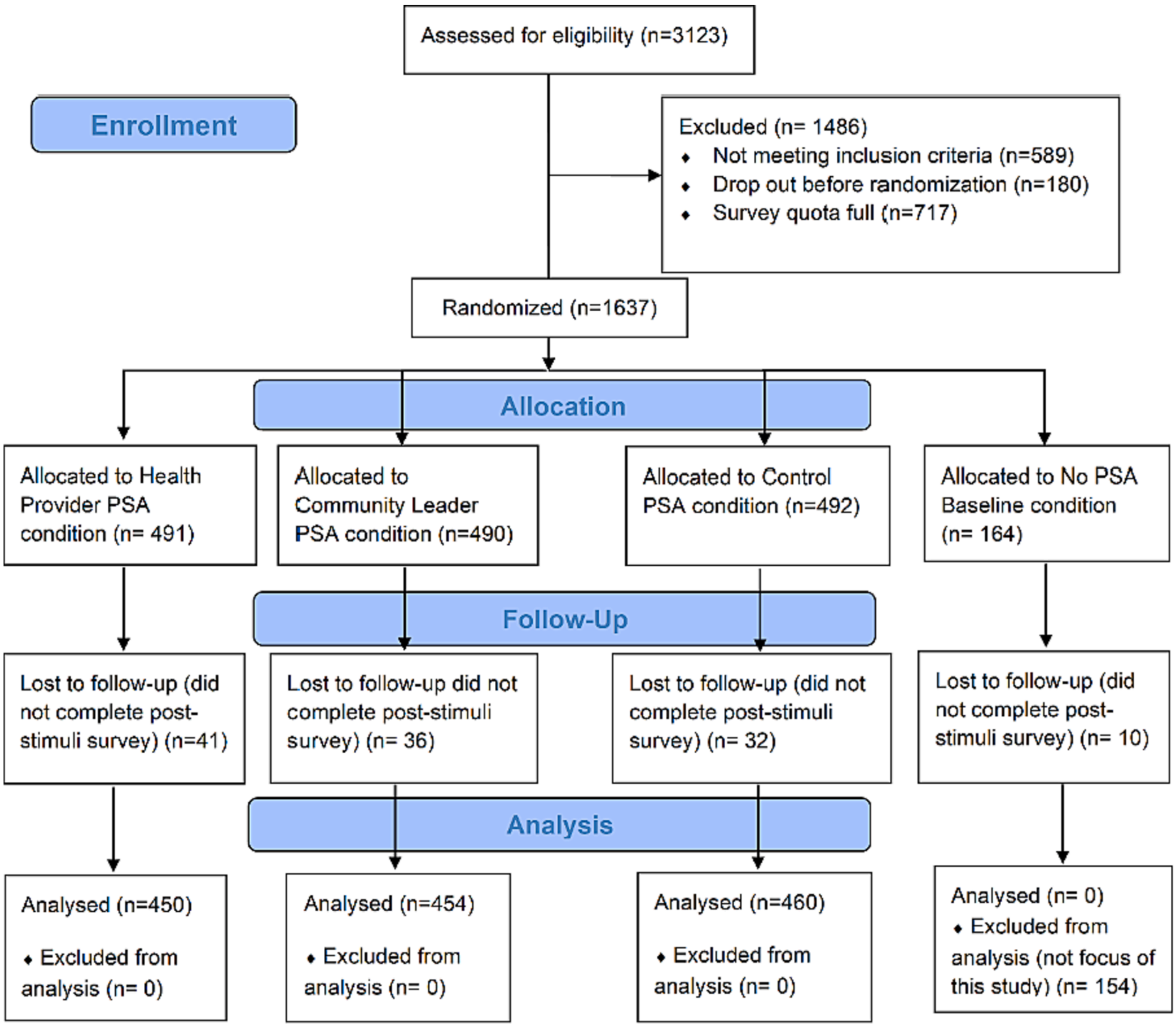

Fig. 1. CONSORT form flow chart.

vaccines: 8 C3 clinician testimonial PSAs, 8 C3 community leader control PSAs, and 8 "Our Doctors" control PSA videos. Following methodological recommendations from researchers studying health message design, (Slater et al., 2015; Jackson, 1992) we used a randomized multiple-message design to improve causal inference. For the clinician versus community leader contrast, the consistently manipulated factor for all eight PSAs in a particular condition was the "messenger", although other attributes of the featured vaccine advocates (e.g., names, clinic affiliations), as well as the details of the stories that they shared, necessarily varied across PSAs. Observed between-condition differences can then be attributed to the consistently manipulated factor of message source. The same argument can be made for the C3 clinician PSAs versus "Our Doctors" control PSAs comparison. This design also has the benefit of improving generalizability over unmanipulated message features as well as over different manifestations of the intended feature factor, (Fong and Grimmer, 2023) while mitigating case-category confounding. (Slater et al., 2015; Jackson, 1992).

We compared C3 clinician testimonial PSAs with (a) C3 community leader PSAs and (b) "Our Doctors" control PSAs in terms of their immediate impacts intentions for getting the COVID-19 vaccines (either primary series or boosters, depending on current vaccination status), willingness to discuss or share the PSA, and intention for social interventions (i.e., promoting COVID-19 vaccines to others). Our expectation was that C3 clinician PSAs would outperform the other two types of PSAs. We also explored whether their effects vary by political ideology and demographics.

The original between-participant experimental design fully crossed the three PSA conditions (C3 clinician PSAs, C3 community leader PSAs, and "Our Doctors" control PSAs) with three social media comments conditions. Since the comments conditions did not produce main or interaction effects, this report focuses on the main effects of the three PSA conditions. Dummies indicating the comments conditions were included as covariates to increase estimation efficiency (for the description of all experimental manipulations, see Appendix C). After responding to measures assessing covariates, participants were randomized into one of the PSA conditions and watched one PSA randomly selected from the condition-specific stimuli pool of eight PSAs. Afterward, participants answered a questionnaire in which they responded to outcome measures detailed below.

This study protocol was approved by the IRB of the University of Wisconsin-Madison. Supplementary Materials including full survey items and moderation analyses can be found on the Open Science Framework depository (link: https://osf.io/t495f/?view_only=17cd7b8b58444b8ea314d2f1a6017746).

2.3. Measures

For participants who had not received any COVID-19 vaccines,

Table 1
Participant Characteristics and Descriptive Statistics of Outcome Variables by Treatment Conditions, Rural Residents in the United States: 2022.

	No testimonial (n = 460)	Community leader testimonial (n = 454)	Clinician testimonial (n = 450)	Overall (N = 1364)
Participant Characteristics				
Vaccine status [*n* (%)]				
Vaccinated	244 (53.0)	243 (53.5)	249 (55.3)	736 (54.0)
Unvaccinated	213 (46.3)	211 (46.5)	195 (43.3)	619 (45.4)
Missing	3 (0.7)	0 (0)	6 (1.3)	9 (0.7)
Gender [*n* (%)]				
Man	187 (40.7)	200 (44.1)	199 (44.2)	586 (43.0)
Non-binary and other	3 (0.7)	3 (0.7)	3 (0.7)	9 (0.7)
Woman	270 (58.7)	251 (55.3)	248 (55.1)	769 (56.4)
Education [*n* (%)]				
High school or lower education	176 (38.3)	179 (39.4)	188 (41.8)	543 (39.8)
College or higher education	284 (61.7)	275 (60.6)	262 (58.2)	821 (60.2)
Parent [*n* (%)]				
Non-parent	310 (67.4)	324 (71.4)	334 (74.2)	968 (71.0)
Parent	150 (32.6)	130 (28.6)	116 (25.8)	396 (29.0)
Ethnicity [*n* (%)]				
Non-Hispanic	432 (93.9)	434 (95.6)	432 (96.0)	1298 (95.2)
Hispanic	28 (6.1)	20 (4.4)	18 (4.0)	66 (4.8)
Party [*n* (%)]				
Democrat	108 (23.5)	95 (21.0)	102 (22.7)	305 (22.4)
Independent	146 (31.7)	149 (32.9)	136 (30.3)	431 (31.6)
Other party	27 (5.9)	24 (5.1)	34 (7.6)	85 (6.2)
Republican	179 (38.9)	186 (41.1)	178 (39.4)	543 (39.8)
Age				
Mean (SD)	47.9 (17.4)	49.0 (16.6)	48.6 (16.9)	48.5 (16.9)
Median [Min, Max]	46.0 [18.0, 90.0]	49.0 [18.0, 90.0]	48.0 [18.0, 90.0]	48.0 [18.0, 90.0]
American Indian or Alaska Native [*n* (%)]				
Yes	24 (5.2)	11 (2.4)	10 (2.2)	45 (3.3)
No	436 (94.8)	443 (97.6)	440 (97.8)	1319 (96.7)
Asian [*n* (%)]				
Yes	4 (0.9)	9 (2.0)	3 (0.7)	16 (1.2)
No	456 (99.1)	445 (98.0)	447 (99.3)	1348 (98.8)
Black or African American [*n* (%)]				
Yes	28 (6.1)	20 (4.4)	25 (5.6)	73 (5.4)
No	432 (93.9)	434 (95.6)	425 (94.4)	1291 (94.6)
Native Hawaiian or Other Pacific Islander [*n* (%)]				
Yes	2 (0.4)	5 (1.1)	3 (0.7)	10 (0.7)
No	458 (99.6)	449 (98.9)	447 (99.3)	1354 (99.3)
White [*n* (%)]				
Yes	413 (89.8)	408 (89.8)	414 (92.0)	1235 (90.5)
No	47 (10.2)	46 (10.2)	36 (8.0)	129 (9.5)
Other Race [*n* (%)]				
Yes	11 (2.4)	15 (3.3)	7 (1.6)	33 (2.4)
No	449 (97.6)	439 (96.7)	443 (98.4)	1331 (97.6)
Descriptive Statistics of Outcome Variables				
Sharing				
Mean (SD)	2.01 (0.991)	2.09 (0.961)	2.16 (1.05)	2.09 (1.00)
Discussion				
Mean (SD)	2.06 (0.997)	2.14 (1.01)	2.20 (1.03)	2.13 (1.01)
Social intervention				
Mean (SD)	4.37 (2.84)	4.37 (2.86)	4.84 (2.95)	4.53 (2.89)
Booster intentions				
Mean (SD)	3.22 (0.981)	3.24 (0.933)	3.23 (0.970)	3.23 (0.960)
Vaccine intentions				
Mean (SD)	1.62 (0.835)	1.61 (0.868)	1.85 (1.01)	1.69 (0.911)

Note. Participants can identify with more than one race.

vaccination intention (Ruiz and Bell, 2021; Kwok et al., 2021; Loomba et al., 2021) was measured: "As you may know, an FDA-authorized vaccine for COVID-19 is now available for free to all adults in the U.S. How likely are you to get vaccinated with any of the currently approved COVID-19 vaccines?" with a 4-point response scale (*1 = Extremely unlikely*; *4 = Extremely likely*). For participants who had at least one dose of COVID-19 vaccines, booster vaccine intention was measured: "As you may know, the CDC recommends that all adults who have received a COVID-19 vaccine get a booster dose after a certain amount of time has passed since their initial vaccination. How likely are you to get a booster when it is recommended next time?" with a 4-point response scale (*1 = Extremely unlikely*; *4 = Extremely likely*).

This study assessed participants' sharing intention (Berger and Milkman, 2012; Milkman and Berger, 2014; Scholz et al., 2017) by asking "Think about the video you just watched, how likely are you to share this video directly with someone you know (via email, direct message, etc.)" with a 4-point response scale (*1 = Extremely unlikely*; *4 = Extremely likely*). Similarly, discussion intention (Hwang, 2012; Morgan et al., 2018) was measured by asking "Think about the video you just watched, how likely are you to talk about this video with a person you know in the next few days?" with a 4-point response scale (*1 = Extremely unlikely*; *4 = Extremely likely*). Participants' intentions for social intervention were measured with two items: "How much would the video you just watched make you want to do the following: (1) tell other people the benefits of COVID-19 vaccines and (2) promote the vaccines to people who have not yet taken them." Responses were given on a 9-point Likert scale (*1 = Not at all*; *9 = Very much*) and averaged between the two items.

Four manipulation check questions were asked to ensure that our experimental manipulations were successful. Participants were asked to rate their agreement to the following statements on a 7-point response scale after viewing the manipulated PSA video (*1 = Strongly disagree*; *7 = Strongly agree*): (1) "The video describes details about someone's personal experiences related to COVID-19;" (2) "The video shares a lot of specific information about how someone thinks and feels about COVID-19;" (3) "The main character featured in this video appears to be a healthcare worker (e.g., doctors, nurses);" and (4) "The main character featured in this video appears to be a community member outside the healthcare industry." Agreement to statement (1) and (2) were averaged into an index to assess the manipulation of the deployment of personal testimonials in PSAs, whereas agreements to statement (3) and (4) were used to evaluate the manipulation of PSAs featuring clinicians versus community leaders, respectively.

Other survey questions assessed pre-treatment covariates, including participants' perceived social norms related to COVID-19 vaccines, moral values, (Graham et al., 2011) trust for healthcare providers and trust for local health and governmental officials. Social norm perception related to COVID-19 vaccines was measured by the question "If you had to guess, about how many of your family and friends have received a COVID-19 vaccine?" (Response options = *None/Some/Many/Almost all)*. To measure moral values of care, purity and liberty (Graham et al., 2011), participants were asked to indicate how well statements related to moral values describe their opinions, from *1 = Does not describe me at all* to *5 = Describes me extremely well*. For example, care-related statements include "I am empathetic toward those people who have suffered in their lives;" and "It pains me when I see someone ignoring the needs of another human being." Purity-related statements include "I think the human body should be treated like a temple, housing something sacred within;" and "People should try to use natural medicines rather than chemically identical human-made ones." Liberity-related statements include "I think everyone should be free to do as they choose, so long as they don't infringe upon the equal freedom of others;" "Society works best when it lets individuals take responsibility for their own lives without telling them what to do." Participants also answered two questions about their trust for local health and governmental officials and trust for health care providers: "How much do you trust each of the following public sources of information about COVID-19, including vaccination?" (*1 = Not at all, 5 = Completely*). All these measures were administrated before the display of message stimuli. They were included to improve statistical estimation efficiency.

2.4. Statistical analyses

Because vaccine intention was only measured among unvaccinated participants, the analytical sample size for this outcome was $n = 619$. Similarly, because booster vaccine intention was only measured among vaccinated respondents, the analytical sample size was $n = 736$. The sample size of analyses was $N = 1{,}364$ for other outcomes. We present two sets of results per outcome (Table 2): an unconditional model without any covariate and a conditional model with covariates (using the Lin estimator (Lin, 2013) for covariates adjustment). Robust standard errors were used in both models. All analyses were performed using the statistical programming language *R* (Version 4.2.1), and all statistical tests were two-tailed. Since both analyses showed similar results, results based on the unconditional models are reported below.

3. Results

Results from the manipulation check analyses show that our experimental manipulations on the recognition of (a) personal testimonials and (b) message source (i.e., clinicians versus community leaders) were both successful. First, compared to the no testimonial "Our Doctors" control PSAs, after viewing the C3 PSAs featuring testimonials from clinicians ($b = 0.50$, $p < .001$, 95 % CI [0.32, 0.68]) and community leaders ($b = 0.43$, $p < .001$, 95 % CI [0.24, 0.61]), participants were more inclined to agree that the stimuli PSAs described details about someone's personal experiences or shared a lot of specific information about how someone thinks and feels about COVID-19, supporting that the manipulation of testimonials was successful.

Second, compared to the C3 PSAs featuring testimonials from community leaders, participants who viewed the no testimonial "Our Doctors" control PSAs ($b = 3.07$, $p < .001$, 95 % CI [2.87, 3.28]), and the C3 PSAs featuring testimonials from clinicians ($b = 2.87$, $p < .001$, 95 % CI [2.66, 3.08]) agreed more that, in the video they just watched, the main character appeared to be a healthcare worker. Similarly, participants who viewed the no testimonial "Our Doctors" control PSAs ($b = -2.20$, $p < .001$, 95 % CI [-2.45, −1.96]), and the C3 PSAs featuring testimonials from clinicians ($b = -2.09$, $p < .001$, 95 % CI [-2.34, −1.84]) were less inclined to agree that, in the video they just watched, the main character appeared to be a community member outside the healthcare industry. Thus, participants successfully recognized our manipulations of featured clinicians versus community leaders.

Results showed that C3 PSAs featuring testimonials from clinicians serving rural communities increased intentions to get COVID-19 vaccines among the unvaccinated group (Fig. 2; Table 2), outperforming "Our Doctors" control PSAs ($b = 0.23$, $p = .015$, 95 % CI [0.04, 0.41]) as well as C3 PSAs featuring testimonials from community leaders ($b = 0.24$, $p = .010$, 95 % CI [0.06, 0.43]). However, we did not find clinician testimonial PSAs to outperform "Our Doctors" control PSAs in improving booster intentions among the vaccinated group ($b = 0.03$, $p = .756$, 95 % CI [-0.14, 0.20]). The effects of the clinician testimonial videos on primary series vaccine intention and booster vaccine intention were not significantly moderated by political ideology, gender, age, education, race, or ethnicity (Appendix A), suggesting comparable effects for subgroups.

Compared with PSAs from the "Our Doctors" campaign, C3 clinician testimonial PSAs also increased intentions for social diffusion, specifically intentions of private sharing ($b = 0.16$, $p = .022$, 95 % CI [0.02, 0.29]), discussion ($b = 0.14$, $p = .032$, 95 % CI [0.01, 0.28]), and social intervention ($b = 0.49$, $p = .011$, 95 % CI [0.11, 0.87]). Such effects were not moderated by political ideology, gender, age, education, race, or ethnicity (Appendix A). C3 clinician testimonial PSAs also outperformed community leader PSAs in increasing intentions for social intervention ($b = 0.48$, $p = .014$, 95 % CI [0.10, 0.86]).

Though not included in our hypotheses, we conducted exploratory analyses comparing community leader testimonial PSAs with the control "Our Doctors" campaign PSAs. There were no significant differences between these two conditions in any of the outcomes tested.

In sum, evidence from the national online experiment demonstrates that PSAs featuring clinicians and their testimonials—but not testimonials from community leaders—produced through a community-engaged approach, can improve intentions for vaccination and social diffusion among rural residents.

4. Discussion

A growing literature has examined a variety of promising message features (Borah et al., 2021; Santos et al., 2021; Ye et al., 2021) to promote COVID-19 vaccines and to address the challenge of vaccine misinformation and online discourses of vaccine refusal. Because clinicians are viewed as a trusted source of health information in the U.S., (Reiter et al., 2020; Head et al., 2020) their vaccine recommendation can be a key determinant of vaccine acceptability. (Reiter et al., 2020) Being the first to receive the COVID-19 vaccine in the U.S., frontline clinicians' storytelling of their firsthand experiences with COVID-19 vaccines can be persuasive. (Katzman and Katzman, 2021).

This report presented evidence from a national online experiment supporting the efficacy of a community-engaged approach to developing vaccine promotional PSAs featuring clinician testimonials, in terms of (a) improving vaccination intentions among unvaccinated rural residents and (b) activating the social route for enhancing campaign reach and influence. This project is a response to the call to improve

Table 2
Effects of PSA Exposure on Intentions for Sharing, Discussion, Social Intervention, Vaccination, and Boosters, Rural Residents in the United States: 2022.

	Vaccination Intentions		Boosters Intentions		Sharing		Discussion		Social Intervention	
	Unconditional model w/o covariates	Conditional model with covariates	Unconditional model w/o covariates	Conditional model with covariates	Unconditional model w/o covariates	Conditional model with covariates	Unconditional model w/o covariates	Conditional model with covariates	Unconditional model w/o covariates	Conditional model with covariates
"Our Doctors" control PSA	−0.23 *(-0.41 – -0.04)	−0.19 *(-0.35 – -0.03)	−0.03(-0.20 – 0.14)	0.02(-0.13 – 0.17)	−0.16 *(-0.29 – -0.02)	−0.12(-0.24 – 0.00)	−0.14 *(-0.28 – -0.01)	−0.12 *(-0.24 – -0.00)	−0.49 *(-0.87 – -0.11)	−0.35 *(-0.65 – -0.06)
Community Leader PSA	−0.24 **(-0.43 – -0.06)	−0.23 **(-0.39 – -0.07)	−0.02(-0.19 – 0.14)	−0.02(-0.17 – 0.12)	−0.07(-0.20 – 0.06)	−0.07(-0.19 – 0.05)	−0.06(-0.19 – 0.07)	−0.07(-0.19 – 0.05)	−0.48 *(-0.86 – -0.10)	−0.45 **(-0.74 – -0.15)
Gratitude + persuasive comments	−0.04(-0.21 – 0.14)		−0.03(-0.20 – 0.15)		0.07(-0.06 – 0.20)		0.08(-0.05 – 0.21)		0.23(-0.14 – 0.61)	
Gratitude comments	−0.06(-0.24 – 0.11)		0.04(-0.12 – 0.20)		0.05(-0.08 – 0.18)		0.05(-0.08 – 0.18)		0.12(-0.26 – 0.49)	
(Intercept)	1.88 ***(1.71 – 2.06)	1.83 ***(1.71 – 1.95)	3.26 ***(3.11 – 3.41)	3.25 ***(3.14 – 3.35)	2.13 ***(2.00 – 2.25)	2.15 ***(2.06 – 2.24)	2.16 ***(2.04 – 2.28)	2.20 ***(2.12 – 2.29)	4.74 ***(4.40 – 5.09)	4.81 ***(4.60 – 5.02)

Note: The *Clinician PSA* condition and the *No comment exposure* condition were set as the reference baseline for comparisons, hence omitted from the table. Unconditional models present main effects of experimental conditions absent covariates and the coefficients were estimated using robust sandwich standard errors. Conditional models present effects of experimental conditions with covariates and the coefficients were estimated using the Lin estimator (i.e., outcome variables were regressed on the condition indicator, covariates after global mean centering, and interaction terms between conditions and globally mean-centered covariates. The robust sandwich estimator for standard errors was used.) (Lin, 2013).
+ $p < 0.01$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

"medically trained 'influencers'" (Oehler, 2020) (*p*. 340) on social media and to help clinicians serving rural communities reclaim the lost ground in the online battlefield fighting vaccine misinformation and refusal.

Specifically, to inform social media campaign message design, our findings highlight the power of combining two components: trusted clinicians as the *messenger* and their personal stories and testimonials as the *message*. The double-control design used in the evaluation study helps us attribute observed impacts on improved vaccination intentions to the integrated package combining both the *messenger* and the *message* treatments, rather than either part alone. Although prior research has shown the credibility and trustworthiness of clinicians in the local community (Reiter et al., 2020; Head et al., 2020) on one hand, and the persuasiveness of narratives and testimonials in health messages (Kreuter et al., 2007; Kim et al., 2012) on the other, our study provides experimental evidence demonstrating their combined impacts on COVID-19 vaccine promotion among rural residents as of spring 2022. We did not observe a similar impact of clinician testimonials on the already-vaccinated group in terms of intentions for taking the boosters, which might be due to this group's high baseline intentions. It is more encouraging to see improvement among the unvaccinated group, who were likely to have already been inundated with vaccine-related information during the intensive rollout period, and hence more difficult to persuade. That said, the C3 PSAs did not feature testimonials that explicitly and directly address the need for booster uptake. Future research should re-test the effectiveness of using clinician testimonials in PSAs to directly encourage booster uptake.

Beyond improving vaccination intentions, the C3 PSAs featuring clinician testimonials also better activated the social route for campaign influence, (Hornik, 2002; Hornik and Yanovitzky, 2003) across several indicators including intentions for social intervention, discussion, and sharing in the national online experiment. In particular, the finding that the combined messaging strategy improved social intervention intentions highlights a promising route to boost vaccine uptake in rural communities—social endorsements from close contacts are powerful motivators for health behavioral changes, (Zhang and Centola, 2019; Cialdini and Goldstein, 2004) especially when trust in institutional sources (Cramer, 2016; Tram et al., 2019) continues to decline in these communities.

5. Limitations

First, despite our study yielding significant findings, we recognize that due to practical constraints and the necessity of executing a social media campaign within a tight schedule, we were unable to keep every aspect of message content in PSAs constant across conditions. When contrasting clinician PSAs with community leader PSAs, imposing excessive restrictions on what the featured vaccine advocates may or may not say could potentially compromise the authenticity of their voices and thus, affect the overall efficacy of the campaign. Although our study design might not eliminate potential confounding from uncontrolled message features, our scrutiny did not pinpoint serious confounders. We provide a summary and links to all original stimuli (see Appendix B) PSAs for readers interested in further scrutiny.

Second, we relied upon self-reported intentions to assess the relative differences in message performance. Future research should collect behavioral data on vaccine uptake and message retransmission whenever feasible. That said, a recent *meta*-analysis (O'Keefe, 2021) concluded that intention measures could provide valid diagnostic signals comparable to behavioral measures. Moreover, our measurements of intention to adopt COVID-19 vaccines and boosters do not specify the timeframe of the vaccine behaviors. A better way could be to ask questions about vaccine behavioral intentions within a specific timeframe. We also acknowledge the limitation of using single-item measures for outcome measures, which reduced our ability to assess measurement reliability. That said, it is worth noting that single-item measures are routinely used to access COVID-19 vaccination

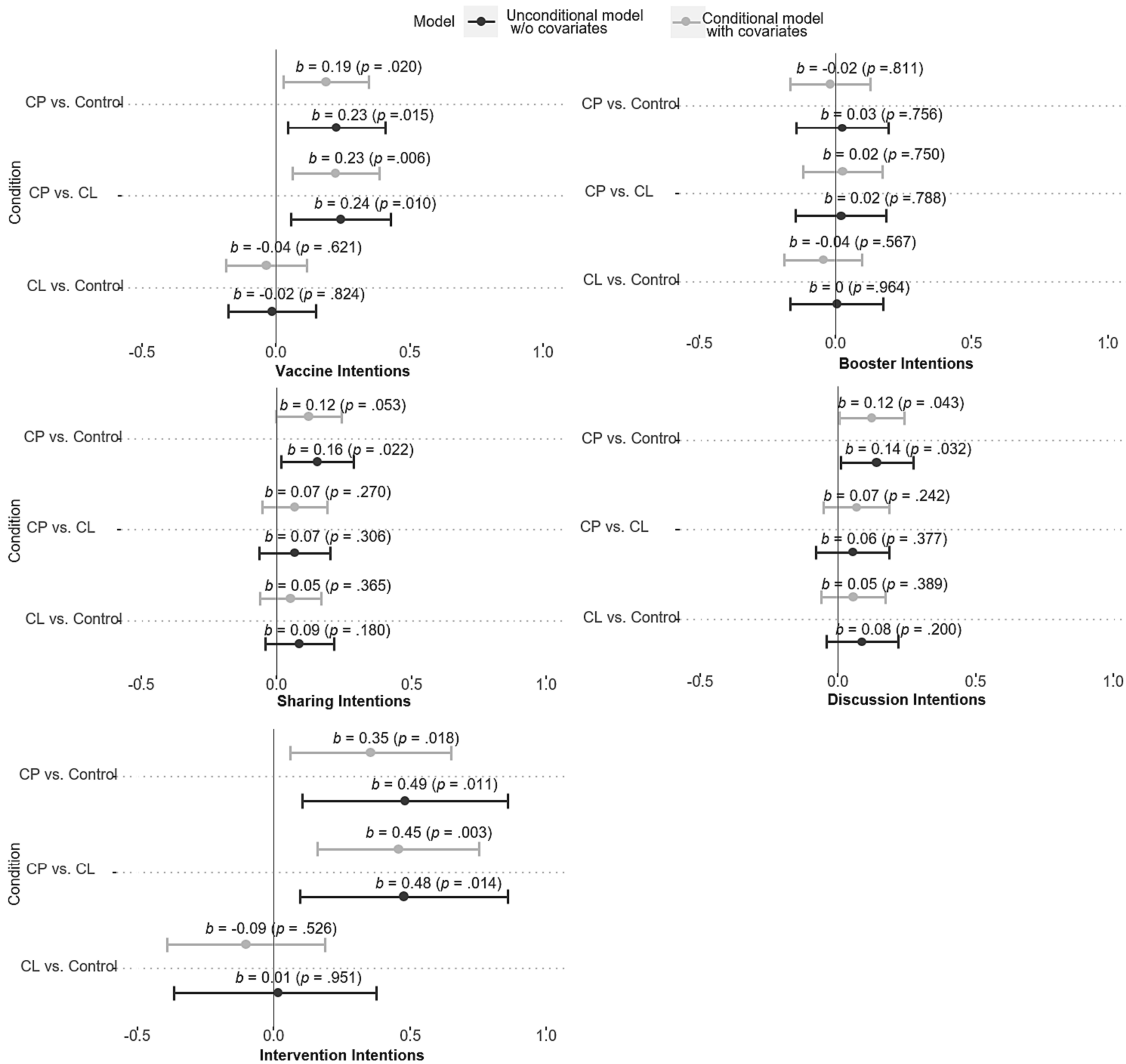

Fig. 2. Effects of PSAs on Intentions for Sharing, Discussion, Social Intervention, Vaccination, and Boosters, Rural Residents in the United States: 2022 *Note:* CP = clinician PSAs. CL = community leader PSAs. Unconditional models present effects of experimental conditions absent covariates and the coefficients were estimated using robust sandwich standard errors. Conditional models present effects of experimental conditions with covariates and the coefficients were estimated using Lin estimator (i.e., outcome variables were regressed on the condition indicator, covariates after global mean centering, and interaction terms between conditions and globally mean-centered covariates. Robust sandwich estimator for standard errors) (Lin, 2013).

intentions, (Ruiz and Bell, 2021; Kwok et al., 2021; Loomba et al., 2021) message sharing (Berger and Milkman, 2012; Milkman and Berger, 2014; Scholz et al., 2017) and discussion (Hwang, 2012; Morgan et al., 2018) in previous research. Future research should compare measurement properties of such single-item measures with multi-item scales.

Furthermore, we fielded this study in Spring 2022, when most people were likely to have already formed their positions about COVID-19 vaccines. This likely has rendered our test a conservative estimate of the effectiveness of featuring clinicians' personal testimonials.

Lastly, the current report focuses on the COVID-19 context only and did not include Spanish versions of PSAs. We encourage other researchers to test the generalizability of the C3 approach to other types of vaccines and in racial and language minorities (e.g., the Hispanic population). Related to this, our sample slanted towards a more educated population. Although education did not significantly moderate the effects of clinician testimonial PSAs on any of the outcomes tested in this study, we encourage future research to examine the effectiveness of clinician testimonials more thoroughly among less educated populations.

6. Conclusion

By collaborating with community and local healthcare system partners, we co-designed a series of promotional PSAs to improve COVID-19 vaccine acceptance in underserved rural communities using a community champion model. Using a national online experiment, we found evidence showing the superiority of combining personal testimonials (the message) with clinicians serving rural communities (the messenger)—not only in terms of increasing vaccination intentions among unvaccinated rural residents, but also the likelihood to increase campaign exposure and wider vaccine acceptance through social diffusion of messages.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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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

Data will be made available on request.

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