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Assessing changes in COVID-19 vaccine uptake and intentions among the *Brigada Digital* Latino social media audience: a repeated cross-sectional study

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Abstract

Background U.S. Latinos experienced disproportionate COVID-19 impacts in terms of morbidity and mortality. Vaccination against COVID-19 is an important strategy for mitigating health impacts, and yet, vaccine uptake was slower among U.S. Latino adults compared to other racial/ethnic groups. Vaccine hesitancy has been a significant barrier within Latino communities, and exposure to misinformation has been associated with negative attitudes toward vaccination. While some COVID-19 mitigation efforts have included community-based outreach, few studies have explored the impact of community-based digital messaging in Spanish to counter COVID-19 misinformation, build trust, and promote vaccination. To address this gap, we conducted a one-year repeated cross-sectional study to assess changes in COVID-19 vaccine uptake, intentions, and perceived norms, as well as barriers to accessing reliable information and levels of trust in COVID-19 information sources among Latino adults exposed to *Brigada Digital de Salud* social media content. This culturally-tailored content disseminated on Facebook, Instagram, and X platforms was amplified by community health workers and partners, and focused on COVID-19 risk and prevention, vaccine safety and efficacy, and correcting related misinformation.

Results Statistically significant increases in COVID-19 vaccination and intentions to vaccinate children were observed from May 2022 (wave 1) to April 2023 (wave 2). Among perceived difficulties accessing information, respondents indicated the most difficulty in judging the reliability of COVID-19 information in the media; however, a statistically significant decrease in perceived difficulty was observed between waves. With regard to trust in COVID-19 information sources, levels of trust were highest for healthcare providers in both waves, and there were statistically significant increases in trust in the FDA to ensure COVID-19 vaccine safety and trust in the federal government to ensure child COVID-19 vaccine safety at wave 2.

Conclusions Social media messaging by trusted community-based sources shows promise as a strategy for combating health misinformation and ameliorating information access gaps for language minority populations. This

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digital approach represents an important tool for deploying critical information to underserved populations in public health emergency and crisis contexts, and for supporting changes in attitudes, trust, and behaviors to improve health outcomes.

Keywords COVID-19, Vaccination, Latinos, Social media campaign, Community-based outreach, Health information access, Misinformation, Language minority populations

Background

Throughout the COVID-19 pandemic, Latinos in the U.S. have been disproportionately impacted by SARS-CoV-2 in terms of morbidity and mortality [1–3]. Within the first year of the pandemic, the Centers for Disease Control and Prevention (CDC) estimated that Latinos were 1.5 times more likely to be infected, 2.3 times more likely to be hospitalized, and 1.8 times more likely to die from COVID-19 in comparison to White, Non-Latino persons [4]. These disparities have been explained, in part, by differences in comorbidity prevalence and social determinants, such as healthcare access, employment in "essential" frontline industries, and socioeconomic factors [5–9].

Vaccination is an important step in reducing the spread and severity of COVID-19. However, vaccine uptake was slower among U.S. Latino adults compared to other racial/ethnic groups [10–13], and Latino children continue to have disproportionately lower vaccination rates in some age categories. In May of 2023, 57% of Latino adults had completed a primary vaccine series while only 9.1% had received a bivalent booster dose. This was the lowest booster dose coverage across all racial/ethnic subgroups, although data on race/ethnicity was incomplete for approximately one-fifth of individuals [14]. Furthermore, as of August 2023, only 28.8% of Latino children ages 5–11 years, 57.8% of those aged 12–15 years, and 70.4% of those aged 16–17 years had completed a primary vaccine series [15]. U.S. Latinos have experienced disproportionate barriers to COVID-19 vaccination, such as challenges with taking time off work, limited transportation and vaccine access, language barriers surrounding vaccine information and scheduling appointments, fear of discrimination, disclosing citizenship status or deportation [14, 16–23].

Vaccine hesitancy has also been a significant barrier among Latinos [5, 10, 12, 16–18]. Studies have established that exposure to COVID-19 vaccine misinformation is associated with negative attitudes towards vaccines, lower trust in science, uncertainty about source reliability, and decreased intention to vaccinate [24–27]. A 2021 review of 13 studies showed that approximately one-third of Latino participants experienced vaccine hesitancy, and that hesitancy was associated with higher levels of exposure to misinformation and medical mistrust [28].

National strategies to address mistrust and increase COVID-19 vaccination rates among Latinos have emphasized the importance of community outreach and engagement; these strategies have focused on mitigating COVID-19 risk and increasing vaccine confidence among vulnerable populations [16, 29–32]. Most commonly, COVID-19 educational efforts targeting U.S. Latinos have been led and implemented by local organizations. These efforts have employed community-based approaches involving community health workers, community leaders, and social media outreach [10, 33–36]. Initiatives such as CDC's WhatsApp-based *Mi Chat Sobre Vacunas COVID* and the Unidos U.S.-led *Esperanza Hope for All* campaign reached audiences on a national level [10, 37, 38].

While there have been initiatives to address COVID misinformation in U.S Latino communities, there have been a lack of studies exploring the impact of community-based digital messaging strategies that counter COVID-19 misinformation in Spanish and promote vaccine uptake. The *Brigada Digital de Salud* (Digital Health Brigade) was established in May of 2021 to address the proliferation of COVID-19 misinformation and narratives fueling vaccine hesitancy within Spanish language social media networks. Spanning across Facebook, Instagram, and X (formerly Twitter), *Brigada Digital de Salud* has disseminated accessible, evidence-based, and culturally appropriate COVID-19 information in Spanish on a weekly basis [39]. This study examines changes in COVID-19 vaccination and related outcomes among *Brigada Digital* Latino audience members.

Methods

Design

We conducted a one-year repeated cross-sectional study to assess changes in self-reported adult and child COVID-19 vaccine uptake, intentions, and perceived norms, difficulty accessing COVID-19 information, and trust in COVID-19 information sources and government institutions to ensure vaccine safety among *Brigada Digital* Latino individuals from the Washington, DC Metropolitan (DMV) area who self-reported being exposed to *Brigada Digital de Salud* social media content.

Intervention

Beginning in May of 2021, we developed and disseminated approximately two to three weekly social media posts in Spanish to educate audience members about: COVID-19 variants, risk, and prevention; testing; vaccine recommendations, safety, and efficacy; COVID-19 treatment options; and to promote resources for vaccination, testing, and prevention. Given the rapidly changing information landscape, *Brigada Digital* social media content also sought to provide regular news and scientific updates, explain changes in COVID-19 policies and vaccine eligibility, and correct COVID-19 misinformation. *Brigada Digital* content was developed for audiences with diverse levels of literacy and education levels, and included explanations of scientific concepts, visual illustrations, and audio narration of text. Content was delivered in varied formats, including carousels, videos, and tutorials (See Fig. 1), details of which are reported elsewhere [39].

From May 8, 2022 to April 5, 2023, we disseminated a total of 141 unique posts once across each of the *Brigada Digital* Facebook, Instagram, and X pages, which were then shared by a trained cadre of 10 community health workers (CHW) with their social media networks and Spanish language, Latino-oriented public DMV-based Facebook groups. *Brigada Digital* CHWs also conducted digital outreach and health promotion activities to engage audience members, answer questions, and connect community members with resources. A comprehensive discussion of *Brigada Digital* content development, topics, communication and community-based outreach strategies, post formats, and overall audience reach and engagement has been published elsewhere [39].

Instrument and measures

The Common Survey 2.0 was developed by the National Institutes of Health's Community Engagement Alliance Against COVID-19 Disparities (NIH CEAL), a national

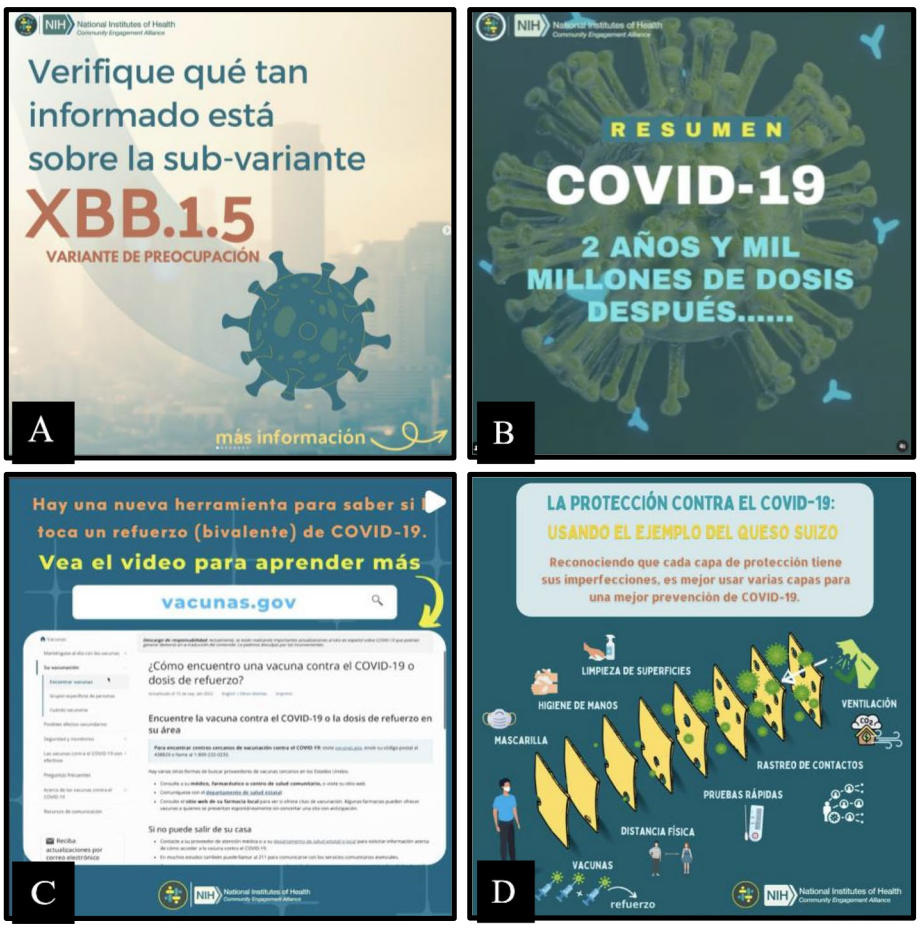

Fig. 1 Examples of *Brigada Digital de Salud* social media content. Panel **A** is a carousel that shares information about the COVID-19 XBB.1.5 variant. Panel **B** is an informational video about public health achievements of COVID-19 vaccination. Panel **C** is a video tutorial that teaches viewers how to determine when they need a COVID-19 booster dose. Panel **D** is an infographic that visually illustrates the benefits of layered COVID-19 mitigation strategies

consortium of regional research collaboratives (See Supplementary Material). The survey instrument was available in English and Spanish; however, given that this research targeted the Latino community and focused on the impact of Spanish-language digital messaging disseminated therein, all surveys were administered in Spanish. The survey instrument included measures for sociodemographics, social media consumption, adult and child COVID-19 vaccine uptake and intentions, adult booster uptake, difficulty accessing COVID-19 information, and levels of trust in COVID-19 information sources and government entities.

Sociodemographic variables included age, place of birth/origin, sex, education level, employment status, and household income. The survey instrument asked participants' birth year, and a variable for respondent age was created by subtracting the year of survey administration (e.g. 2022) from the respondent's reported year of birth (e.g. 2021–1975, yielding an age for the respondent of 46). Age categories were then created, including: 18–25, 26–35, 36–45, 46–55, 56–63, and 64+. The survey instrument included eight response options for household income, which was simplified by collapsing household income into four categories, including $15,000-$34,999, $35,000-$74,999, $75,000-$100,000>, and "declined to answer." Likewise, the original variable for educational attainment was collapsed from eight categories to three, including "Less than high school/Some high school," "High school graduate/GED/some college," and "Associates, Bachelor's or Postgraduate degree."

Participants' English language competency was assessed on a 5-point Likert scale from "Speaks English very well" to "Does not speak English at all," with higher mean scores representing greater English competency. Participants were also asked whether they had ever been diagnosed with a chronic health condition and whether they had health insurance coverage. In addition, the survey included questions about time spent consuming social media, social media platforms used, and sources from which they obtained COVID-19 information (i.e., healthcare provider, faith leader, news outlet, social media, federal government). Daily amount of time spent consuming social media was captured using a 5-point Likert scale from "None" to "Six hours or more." Participants were asked to indicate which social media platforms they used, for example, Facebook, WhatsApp, Twitter (now X), Instagram, TikTok, and Snapchat. Sources from where respondents obtained COVID-19 information (i.e., healthcare provider, local television channel, social media, friends or family in the U.S., state or local government, and federal government agencies) were assessed using a 4-point Likert scale with options ranging from "None of my information" to "All of my information" from each specific source. Higher means (ranging from 1–4) indicate more COVID-19 information was obtained from that particular source.

Primary outcomes

Self-reported adult COVID-19 vaccine uptake, adult booster dose uptake and intentions, and COVID-19 vaccine uptake and intentions for their children under age 18 were assessed as primary outcomes. To assess adult COVID-19 vaccine uptake, participants were asked whether they had received at least one dose of the COVID-19 vaccine, with the response options including, "I received one dose of a two-dose series," "I received both doses of a two-dose series," "I received a one-dose vaccine," and "I have not been vaccinated against COVID-19." For participants indicating that they had received a one-dose vaccine or both doses of a two-dose series, they were also asked whether they had ever received a booster dose, with response options including, "I received a booster dose," "I received more than one booster dose," "I have not received a booster dose, but I plan to," and "I have not received a booster dose, and I do not plan to." Results related to vaccine intentions are reported separately from vaccine uptake results.

Among participants indicating that they were a parent/guardian of at least one child under age 18, child vaccine uptake and parent intentions to vaccinate their child(ren) was assessed by asking whether they were in favor of vaccinating their child/ren against COVID-19, with response options including, "Yes, child/ren is/are already vaccinated," "Yes, I plan to vaccinate my child/ren," "No, I do not plan on vaccinating my child/ren," and "I'm unsure/undecided."

Secondary outcomes

Perceived difficulty accessing COVID-19 information, trust in different COVID-19 information sources, trust in the FDA to ensure COVID-19 vaccine safety, and trust in the federal government to ensure COVID-19 vaccine safety for children were assessed as secondary outcomes. Perceived levels of difficulty "finding needed COVID-19 information," "finding COVID-19 information in my preferred language," and "judging whether COVID-19 information in the media was reliable" were assessed using three survey questions. Items were assessed using a 4-point Likert scale, and response options included "Difficult," "Somewhat difficult," "Somewhat easy," and "Easy," with higher mean scores indicating greater difficulty.

Participants' levels of trust in various sources of COVID-19 information (i.e., healthcare provider, state government, federal government) were assessed with a 3-point Likert scale using response options of "Not at all," "A little," and "A great deal," with higher mean scores

indicating greater trust in that particular information source. Two items also assessed participants' levels of trust in the U.S. Food and Drug Administration (FDA) and the federal government to ensure COVID-19 vaccine safety generally and specifically for child COVID-19 vaccines. Responses for those two items were assessed using a 3-point Likert scale of "Not at all," "A little," and "A great deal," with higher mean scores indicating greater levels of trust.

Participant reactions to Brigada Digital content

To assess reactions to the content, respondents were provided with four statements, including "*Brigada Digital* posts are informative," "I trust the information that I receive from *Brigada Digital*," "Posts address my concerns about the COVID-19 vaccine," and "The way the information was presented in posts kept my interest." Participants were then asked to indicate the degree to which they agreed/disagreed with these statements using a 5-point Likert scale ranging from "Completely Agree" to "Completely Disagree," with higher mean scores suggesting greater agreement with the statement.

Participant recruitment and sample

To assess changes in COVID-19 vaccine–related outcomes of *Brigada Digital* audience members, we administered the CEAL Common Survey 2.0 in two distinct waves: May 2022 ($n=192$) and April 2023 ($n=123$). The survey was administered in Spanish and eligible participants were Spanish-speaking Latino adults ages 18 or older who resided in either DC or Maryland (specifically in Prince George's or Montgomery Counties). Participants were identified from among the social media network members of 10 *Brigada Digital* CHWs based in DC or Maryland. A convenience sample of participants were recruited by *Brigada Digital* CHWs sharing the digital flier in posts to their social media networks. Participants contacted the study team to complete a survey by using a phone number included in the flier.

Data collection

Following informed consent, surveys were administered in Spanish using an interview format by trained, Latino data collectors by phone. Participant responses were entered directly into REDcap by data collectors using a tablet or laptop computer. The survey took approximately 35 min to complete, and participants received a $25 gift card incentive. All instruments and protocols were approved by the GW Institutional Review Board.

Data analysis

To determine the comparability of wave 1 and 2 sample characteristics, we conducted descriptive analyses for socio-demographic, language competency, and health status variables. Chi-squares tests were used for categorical variables and t-tests were used for continuous variables. Means and standard deviations or frequencies and percentages were reported, respectively. In all analyses, the primary independent variable was the wave at which the survey was administered. Subsequent analyses discerned variations in dependent variables as a function of data collection wave.

To assess the primary outcomes of adult vaccine and booster dose uptake, booster intentions, and child vaccine uptake and parent intentions, odds ratios were estimated using logistic regression, while controlling for age, sex, income, language competency, and health insurance status. We controlled for age given its direct correlation with COVID-19 risk levels and the potential influence of age-based vaccine recommendations outcomes for vaccine uptake. Beyond these specific COVID-related reasons, age is generally an important factor to adjust for in health research due to its multifaceted implications on health behavior and outcomes. We also controlled for sex given that women tend to be higher users of healthcare services, including preventative care measures such as vaccination. Additionally, we controlled for income, language competency, and health insurance status since waves 1 and 2 exhibited statistically significant differences for these variables, all of which can influence healthcare access and behaviors.

The survey instrument included items that originally assessed COVID-19 vaccine/booster uptake and intentions concurrently in the same item for adults and children. Therefore, for analytical clarity, these original items were dissected into discrete dummy variables that were generated using response options corresponding to each distinct outcome. This approach permitted a precise portrayal of each distinct outcome; for example, future vaccination intentions could be assessed only among individuals who had yet to be vaccinated with the primary series.

For the secondary outcomes of difficulty accessing COVID-19 information, trust in COVID-19 information sources and the government, and exposure and reactions to *Brigada Digital* social media content, since all variables were assessed using Likert-type response formats, they were treated as continuous variables. Paired t-tests were executed for each variable to discern any differences in these outcomes between waves 1 and 2. For these paired t-tests, a difference was deemed statistically significant if the means differed at a significance threshold of $P<0.05$. Means and standard deviations are reported for these variables.

To determine whether there were differences in responses between waves 1 and 2 for participant reasons

for not vaccinating children and self-reported exposure to *Brigada Digital* social media content, chi-square tests were performed, with the level of significance demarcated at $P<0.05$. Frequencies and percentages are reported for these variables. All analysis was conducted using STATA 17.

Results

Descriptive results that characterize the study population's sociodemographics and social media consumption practices are reported first, followed by participant self-reported exposure and reactions to *Brigada Digital* content. Then, results for primary (vaccine uptake and intentions) and secondary (perceived difficulty accessing COVID-19 information and information source trust) outcomes are presented.

Study participant sociodemographics and other characteristics are shown in Table 1. The majority of study participants were women, representing almost two-thirds of participants at each time point, and respondent mean age for waves 1 and 2 were similar, at 43.2 years and 42.5 years, respectively.

Approximately two-thirds of respondents indicated that they were born outside the U.S., most commonly of Central American origin, in particular from El Salvador, Honduras, and Guatemala. A majority of respondents indicated that they spoke a language other than English at home (96.3% in wave 1 and 99.2% in wave 2), and moderate English language proficiency levels were reported, with wave 2 participants reporting slightly higher proficiency (M = 2.70, SD = 1.52) than wave 1 participants (M = 2.25, SD = 1.43) ($P=0.03$). Just under half of participants said they had completed high school, a GED, or had at least some college, and just over three-quarters of respondents reported being employed. While just over half of wave 1 respondents indicated that they earned an annual household income between $15,000-$34,999, nearly half of respondents declined to answer the question about income at wave 2. While a substantial proportion of individuals reported having health insurance at wave 1 (83.1%), a lower proportion were insured at wave 2 (72.1%) ($P=0.01$).

Results for self-reported social media consumption and platforms used are presented in Table 2. A majority of respondents indicated that they spent considerable time using social media, with most spending either 1–3 or 3–6 h per day. In terms of social media platforms used, WhatsApp, YouTube, and Facebook were among the top platforms, and the least used platforms were Twitter (now X) and Snapchat.

When asked how much of their COVID-19 information was obtained from specific sources and channels, the most common at both time points included federal or state/local government agencies, followed by social media, friends/family in the U.S., a healthcare provider, and local television/cable news (see Appendix A). At both time points, respondents reported obtaining a greater proportion of COVID-19 information on social media than from healthcare providers, and social media outpaced news outlets and state or local governments as COVID-19 information sources.

Table 1 Participant sociodemographics and characteristics

Variables	Wave 1 ($n=192$)		Wave 2 ($n=123$)		*P* value
	n	%	n	%	
Age groups					.26
18–25	35	18.2	16	13.0	
26–35	32	16.7	32	26.0	
36–45	33	17.2	18	14.6	
46–55	46	23.9	36	29.3	
56–63	21	11.0	8	6.50	
64 +	20	10.4	11	8.9	
Not reported	5	2.60	2	1.63	
Sex					.88
Male	75	39.1	47	38.2	
Female	117	60.9	76	61.8	
Birthplace					.13
US	75	39.1	38	30.9	
Non-US	116	60.4	85	69.1	
Missing	1	0.52	0	0.00	
Level of education					.64
Less than HS, some HS	36	18.9	18	14.6	
HS grad, GED, some college	80	41.9	55	44.7	
Associate, bachelor, postgraduate	74	38.7	48	39.0	
Missing	1	0.52	2	1.63	
Employment status					.25
Employed	151	78.7	95	77.2	
Unemployed	16	8.3	6	4.9	
Other (disabled, student, retired)	25	13.0	22	17.9	
Household income					< .001***
< $15,000-$34,999	104	54.2	19	15.5	
$35,000-$74,999	48	25.0	15	12.2	
$75,000-$100,000 >	33	17.2	28	22.8	
Declined to answer	7	3.7	61	49.6	
Have health insurance*	159	83.1	88	72.1	.01*

* = *P* value < .05, ** = *P* value < .01, *** = *P* value < .001

Self-reported exposure and reactions to Brigada Digital content

The self-reported frequency of exposure to *Brigada Digital* content, the source of this content, and actions they took in response to the content were assessed in waves 1

Table 2 Self-reported daily social media consumption and platforms used

Time spent on an average day…	Wave 1 ($n=192$)		Wave 2 ($n=123$)		*P* value
	n	%	n	%	
Using social media					.26
None	8	4.2	2	1.6	
< 1 h	32	16.7	15	12.2	
1–3 h	85	44.3	69	56.1	
3–6 h	50	26.0	28	22.8	
6 + hours	17	8.9	9	7.3	
Not reported	0	0.0	0	0.0	
Social media platforms used					
Facebook	163	84.9	94	76.4	.06
Instagram	111	57.8	63	51.2	.25
X	43	22.4	17	13.8	.06
WhatsApp	174	90.6	111	90.2	.91
YouTube	171	89.1	117	95.1	.06
Snapchat	43	22.4	22	17.9	.33
TikTok	69	35.9	56	45.5	.09

* = *P* value < .05, ** = *P* value < .01, *** = *P* value < .001

and 2 (see Appendix B). The most likely channel through which participants were exposed to content was a personal social media contact (38.4%), followed by messages disseminated via church (23.8%) and community health center (17.8%) partner social media accounts. In terms of self-reported frequency of exposure to *Brigada Digital* content, about 24.8% of respondents indicated seeing this content a few times per week, while 27% indicated exposure once or more per day. The most common action taken in response to seeing content was to read the post (96.5%), followed by sharing the post (22.5%). Details regarding audience reach and engagement metrics resulting from Brigada Digital social media posts, as well as content formats, are reported elsewhere [39].

Participant reactions to *Brigada Digital* content were assessed among wave 2 participants only. Overall, participants reported positive reactions to the content (see Table 3).

Respondents considered posts to be informative (M = 3.95, SD = 0.73), and indicated that they trusted the information they received from *Brigada Digital* (M = 3.72, SD = 1.02). Similarly, respondents said that posts addressed their concerns about the COVID-19 vaccine (M = 3.91, SD = 0.70), and that the way the information was delivered held their interest (M = 3.74, SD = 0.99).

Primary outcomes

With regards to COVID-19 vaccine uptake, a significant increase was observed from wave 1 to wave 2 in respondents indicating that they (OR = 6.48, 95% CI [2.73, 15.33]) or their children (OR = 6.00, 95% CI [2.15, 16.64]) had received the primary vaccine series. Respondents from wave 2 had 6.48 times the odds of having received the COVID-19 vaccine themselves, and six times the odds of having had the vaccine administered to their child(ren) (see Table 4).

With regard to the proportion of respondents reporting having received the COVID-19 primary vaccine series, at wave 2, 92.7% of respondents reported being vaccinated, compared to 61.9% in wave 1. A similar upward trend was observed for child vaccination, with 73.6% of respondents indicating they had vaccinated their child(ren) against COVID-19 in wave 2, compared to 32.4% in wave 1. Both of these outcomes showed statistically significant differences from wave 1 to 2 ($P < 0.001$). For booster dose uptake, 78.8% of adult respondents in wave 2 had received a booster dose, compared to 64.0% in wave 1. While there were increases in adult booster dose uptake and intentions to receive a booster dose from wave 1 to wave 2, these results were not statistically significant. Respondents who had never received a COVID-19 booster dose ($n=60$ across both waves) were asked

Table 3 Reactions to *Brigada Digital* content

Statements about *Brigada Digital* content	Wave 2 ($n=123$)	
	M[a]	SD
Brigada Digital posts were informative	3.95	0.73
I trust the information I received from *Brigada Digital*	3.72	1.02
Brigada Digital posts addressed my COVID-19 vaccine concerns	3.91	0.70
The way *Brigada Digital* delivered information kept me interested	3.74	0.99

[a] Reactions are expressed with a mean score (range 1–5), with higher values indicating greater agreement with statements about *Brigada Digital* content

Table 4 Adjusted Odds Ratio of COVID-19 Vaccine/Booster Dose Uptake and Intention

Variable	Wave 2		
	Adjusted OR[a]	95% CI	*P* value
Received vaccine	6.48	2.73, 15.33	< .001***
Received booster dose	1.78	0.86, 3.64	.12
Intention to receive booster dose[b]	1.25	0.59, 2.61	.56
Child(ren) received vaccine	6.00	2.16, 16.65	< .001***
Intention to vaccinate child(ren)	4.81	1.66, 13.93	.004**

* = *P* value < .05, ** = *P* value < .01, *** = *P* value < .001

[a] Odds ratios adjusted for income, sex, age, language, and health insurance status

[b] Responses from participants who have not yet received a booster dose

to provide reasons for their decision. The most common reasons given for having not yet received the booster dose included not wanting to have secondary side effects (51.7%) and a belief that a booster dose was unnecessary (30.0%).

Among respondents who had not yet vaccinated their child(ren) against COVID-19, there was a significant increase from wave 1 to wave 2 in respondent intentions to vaccinate their child(ren) under age 18 (OR = 4.81, 95% CI [1.66, 13.93]). Respondents who had not yet vaccinated their child(ren) against COVID-19 were asked to provide reasons for this decision ($n = 64$ across both waves). Parents/guardians identified a number of reasons for which they chose not to vaccinate their children against COVID-19. The most cited reason across both waves was a concern about potential side effects of the vaccine when administered to children (14.9%). Other common reasons included mistrust in the development process for the vaccine, concern about vaccine efficacy for children, and a belief that the vaccine is not needed because children are at low risk of becoming seriously ill from COVID-19. See Appendix C for full results.

Secondary outcomes

When asked about perceived difficulty finding COVID-19 information in their preferred language, respondents reported a slight decrease in perceived difficulty from wave 1 (M = 1.36, SD = 0.54) to wave 2 (M = 1.35, SD = 0.66), but results were not significant (see Table 5).

Additionally, respondents reported the most difficulty in judging the reliability of COVID-19 information in the media; however, a statistically significant decrease in perceived difficulty was observed from wave 1 (M = 2.97, SD = 0.92) to wave 2 (M = 2.50, SD = 1.17) ($P < 0.001$). Despite these improvements, participant responses indicated a slight increase in perceived difficulty finding needed COVID-19 information from wave 1 (M = 1.42, SD = 0.61) to wave 2 (M = 1.54, SD = 0.86), though this increase was not statistically significant.

Respondents were also asked about their level of trust in the federal government to ensure COVID-19 vaccine safety for adults and children. There was a statistically significant increase for trust in the FDA to ensure COVID-19 vaccine safety from wave 1(M = 2.02, SD = 0.87) to wave 2 (M = 2.37, SD = 0.74) ($P < 0.001$), and a significant increase for trust in the federal government to ensure child COVID-19 vaccine safety from wave 1 (M = 1.87, SD = 0.88) to wave 2 (M = 2.30, SD = 0.76) ($P < 0.001$).

Respondents also reported having high levels of trust in the Centers for Disease Control and Prevention (CDC). Trust in all listed COVID-19 information sources increased significantly from wave 1 to wave 2, with the exception of healthcare providers, for which the mean score did not differ significantly between waves. With regards to trust in different COVID-19 information sources, respondents across both waves reported having the greatest trust in healthcare providers compared to other sources, with a mean score of 2.47 (SD = 0.53) in wave 1 and 2.55 (SD = 0.53) in wave 2.

Table 5 Perceived difficulty accessing and levels of trust in COVID-19 information

Perceived difficulty statements	Wave 1 ($n = 192$)		Wave 2 ($n = 123$)		*P* value
	M[a]	SD	M[a]	SD	
Difficulty finding needed COVID-19 information	1.42	0.61	1.54	0.86	.12
Difficulty finding COVID-19 information in preferred language	1.36	0.54	1.35	0.66	.88
Difficulty judging whether COVID-19 information in the media was reliable or not	2.97	0.92	2.50	1.17	< .001***
Level of trust in…	**M[b]**	**SD**	**M[b]**	**SD**	***P* value**
Information sources					
Healthcare Provider	2.47	0.53	2.55	0.53	.21
Federal Government	1.96	0.81	2.22	0.65	.003**
State or Local Government	1.97	0.82	2.23	0.65	.003**
Centers for Disease Control and Prevention	2.14	0.81	2.42	0.64	.002**
Agencies overseeing vaccine safety					
Trust federal gov't to ensure COVID-19 vaccine safety	2.02	0.87	2.37	0.74	.001***
Trust FDA to ensure COVID-19 vaccine safety for children	1.87	0.88	2.30	0.76	.001***

* = *P* value < .05, ** = *P* value < .01, *** = *P* value < .001

[a] Perceived difficulty is expressed with a mean score (range 1–4), with higher values indicating greater difficulty

[b] Trust in COVID-19 information source is expressed with a mean score (range 1–3), with a higher value indicating greater trust in the source

Discussion

Results demonstrated that study participants were avid consumers of social media, with a considerable proportion of individuals reporting spending hours per day using these platforms. Other studies have shown similar patterns, including high Facebook and YouTube use among Latinos nationally, with 72% reporting using Facebook and 85% reporting using YouTube in 2021 [40], compared to 76.4% of study participants using Facebook and 95.1% using YouTube in 2023. Use of the WhatsApp and TikTok platforms have also shown tremendous growth in recent years, as demonstrated by 90.2% and 45.5% of respondents, respectively, reporting using these platforms in 2023, compared to 46% and 31% of Latinos reporting using these platforms nationally in 2021. Respondents tended to be predominantly women between the ages of 26–55, which mirrors the audience that follows *Brigada Digital* social media accounts [39]. Study participants also tended to have slightly higher educational levels in 2023 than the national average, with 83.7% having completed high school/GED or higher, compared to 75.4% of U.S. Latino adults in 2021 [41]. With regards to health insurance status, more study respondents (27.9%) reported being uninsured in 2023 compared to than Latinos at the national level in 2021 (17.7%).

Respondents reported being reached by *Brigada Digital* content predominantly through social media network contacts, their church's social media account, or the account of a community health center. These channels reflect our primary outreach and engagement strategies through individuals and institutions that are known and trusted, including CHWs and community-based organizations. Approximately 41% of respondents indicated that they were exposed to *Brigada Digital* content a few times per week to once per day, which is consistent with the frequency with which we disseminated content. For individuals who were not following *Brigada Digital* pages directly, this frequency of exposure likely varied depending on the frequency with which each CHW shared and reposted content to their social media networks. While the majority of respondents (96.5%) said that they read *Brigada Digital* posts when received, fewer respondents shared the content with their networks (22.5%), commented (9.8%), or liked/reacted (8.6%). Future efforts should identify strategies to further augment audience engagement. Respondents reacted positively to *Brigada Digital* content, finding it to be informative, trustworthy, and addressing their concerns. Given the overall higher levels of mistrust of COVID-19 information on social media, this reported trust in *Brigada Digital* content can possibly be explained by the information sources being known and trusted individuals or community organizations, and the content being culturally- and linguistically-appropriate.

With regards to COVID-19 vaccine outcomes, study results showed that there were significant differences between the responses of wave 1 and wave 2 participants across primary COVID-19 vaccine-related outcomes. Specifically, respondents in wave 2 were significantly more likely to have received the initial COVID-19 vaccine series (92.7%) compared to respondents in wave 1 (61.9%). This represents a level of vaccine uptake that is substantially higher than Latinos nationwide—only 57% of U.S. Latino adults had completed a primary COVID-19 vaccine series as of May 2023, close to the time of wave 2 survey administration [13]. Additionally, 73.6% of study respondents indicated that they had vaccinated their child(ren) under age 18 against COVID-19, yet only 28.8% of U.S. Latino children ages 5–11 years, 57.8% of those ages 12–15 years, and 70.4% of those ages 16–17 years had completed the vaccine series by August 2023 [15].

Additionally, there was only modestly higher booster dose uptake at wave 2 compared to wave 1, and these differences were not significant. This lack of significance is likely explained by a relatively high rate of booster dose uptake at both time points, or 64.0% at wave 1 and 78.8% at wave 2. Again, this level of uptake far exceeds booster dose uptake by Latino adults nationwide, which was 8.5% as of May 2023 [14]. These higher levels of vaccine series and booster uptake among study respondents compared to Latinos nationally likely signal potential disparities across different Latino communities and U.S. regions that merit further investigation. This result may also reflect a high level of prioritization of health and endorsement of COVID-19 vaccination among audiences who follow the *Brigada Digital de Salud* on social media, or who are connected with community health workers or partner organizations in social media networks.

When asked about levels of trust in different sources of COVID-19 information, trust increased overall from wave 1 to wave 2, which may potentially reflect respondents' increasing familiarity with COVID-19 as a risk and healthcare providers' and government entities' ability to disseminate information to communities as more was learned about the virus and vaccines. Interestingly, study results showed that while respondents' most trusted source of COVID-19 information was healthcare providers, a finding demonstrated by other studies [42–44], the sources from which they reported obtaining a greater proportion of their COVID-19 information included other sources of information or channels such as social media and television news outlets. Additionally, in wave 2, social media outpaced news outlets and state/local governments as a source of COVID-19 information.

Similarly, a 2021 study reported that Spanish-speaking Latinos in Washington state obtained more COVID-19 information from television than healthcare providers, followed by social media and community-based organizations [45]. Another 2021 study also found that among Pittsburgh-area Black and Latino respondents, the most frequently used COVID-19 information sources were the local TV news (66%) or friends and family (64%), followed by, among other sources, the national news (59%), the CDC (49%), local doctors (48%), and the county health department (45%) [46]. Furthermore, while significant decreases were observed in participants' perceived difficulty in judging the reliability of COVID-19 information in the media, study results signaled that judging information reliability continued to be a challenge for participants in wave 2. These findings provide further evidence in support of approaches like *Brigada Digital* that aim to increase access to reliable COVID-19 information in Spanish and to build community capacity to distinguish between reliable and unreliable health information in digital environments. Patterns of social media consumption among study participants also highlight the relevance of strategies that aim to build the capacity of trusted messengers, in particular healthcare providers and CHWs, to reach these audiences on digital platforms.

Limitations

There were several limitations that should be considered when interpreting study results. The study employed a one-group repeated cross-sectional design. Given that the survey was administered to different individuals in waves 1 and 2, it is difficult to make definitive statements about changes in outcomes over time. Study participants included a modest sample size of Latino adults from the Washington, DC metropolitan area who were predominantly foreign-born and originating from Central American countries, suggesting that results may not be generalizable to all U.S. Latino subgroups. Given that a non-probability-based sampling strategy was used, this introduced the possibility of selection bias, in that individuals who were willing to engage with digital media content as a conduit for health messaging or participate in a health-related survey may share a tendency towards greater interest in and commitment to their health in general. Further, exposure to *Brigada Digital* material was self-reported, making it difficult to precisely quantify levels of exposure. Additionally, given that information about COVID-19 and vaccination was available prior to the study and became increasingly available as the pandemic progressed, it is difficult to differentiate between changes attributable to the intervention and those which may have resulted from exposure to other sources of information. For example, we identified at least two other local or state-wide initiatives reaching Latinos that were implemented, including the *Sin Duda* campaign described by Shah and colleagues (2023), which entailed two social media campaign modules lasting 6–8 weeks each from March 2021 to March 2022 (prior to our study period) [47]. The Latino Health Initiative of the Montgomery County Department of Health and Human Services also disseminated COVID-19 messaging via social media that reached local Latino audiences [34]. Cross-contamination that occurred given these initiatives with a similar purpose are entirely possible. Equally important to note is the presence of misinformation about COVID-19 within the digital community throughout the pandemic. While a measure of changes in the quantity of disinformation present in the community was beyond the scope of this work, it is important to acknowledge that such changes have the potential to impact participants' attitudes or beliefs about vaccination or health behaviors related to COVID-19. Taken together, these limitations invite further study in an effort to more firmly establish links between digital health messaging and COVID-19 vaccine-related outcomes. It is important to note that outcomes described here are the result of a pilot study, and therefore present a number of opportunities for further research. Study results suggest the importance of social media as a tool for the dissemination of reliable health information, which may be particularly useful in reaching communities that commonly experience barriers to accessing health-related information and services. Results also underscore the importance of identifying and utilizing trusted sources for the delivery of information, and the ways in which the delivery of accurate health information is linked with changes in health behaviors, intentions and perceived behavioral norms.

Conclusions

The *Brigada Digital de Salud* was established to reduce Spanish language COVID-19 information access barriers and combat misinformation on social media that fuel vaccine hesitancy among Latino audiences. Importantly, this effort leveraged community-based strategies and reputable, familiar sources of information to build trust and promote vaccine uptake. This study offers important insights into Latino audience segments that can be reached using similar digital strategies, as well as audience reactions to culturally- and language-appropriate social media content promoting COVID-19 risk mitigation. While further research is needed to test the digital community-based approach, study results show promise in terms of vaccine-related behaviors, intentions, and perceptions. Future research that seeks to employ a similar approach should aim to build community capacity to conduct digital community-based outreach and health

promotion, and build community capacity to navigate the complex health information environment to locate reliable health information through improved digital health literacy.

Abbreviations

CHW	Community Health Worker
CDC	Centers for Disease Control and Prevention
NIH	National Institutes of Health
CEAL	Community Engagement Alliance Against COVID-19 Disparities
DMV	Washington DC Metropolitan Area
FDA	Food and Drug Administration
GED	General Education Development
HS	High School

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Authors' contributions

C.R.V.S Methodology, Software, Formal Analysis, Writing–Original Draft Preparation, Writing–Review and Editing; E.L.A.Conceptualization, Methodology, Software, Formal Analysis, Funding Acquisition, Writing–Original Draft Preparation, Writing–Review and Editing, Supervision, Project Administration; S.C. Methodology, Software, Formal Analysis, Writing–Original Draft Preparation, Writing–Review and Editing; N.L. Writing–Original Draft Preparation, Writing–Review and Editing, Visualization; A.I.G Writing–Review and Editing, Visualization, Project Administration; C.F. Project Administration; V.G. Project Administration; C.P. Project Administration; M.D.R. Project Administration; M.C.E. Conceptualization, Methodology, Funding Acquisition. All authors have read and agreed to the published version of the manuscript.

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Availability of data and materials

The data presented in this study are available on request from the corresponding author. Data is not publicly available due to the current regulation on privacy.

Declarations

Ethics approval and consent to participate

All study protocols were reviewed and approved by the George Washington University Committee on Human Research (FWA00005645)—Institutional Review Board (IRB), study #NCR213842 on 14 October 2021. All study procedures were performed in accordance with IRB guidelines for the protection of human subjects and ethical principles outlined in the Declaration of Helsinki. Informed consent was obtained from all study participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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