MODELING VACCINE CONFIDENCE INTERVENTIONS FOR MARGINALIZED MIGRANT COMMUNITIES: A MIXED METHOD APPROACH TO LEVERAGING SOCIAL MEDIA NARRATIVES

Research Report | March 2022

MESA | THE MEDIA ECOLOGY AND STRATEGIC ANALYSIS GROUP

ABOUT MESA

The Media Ecology and Strategic Analysis (MESA) is an interdisciplinary group with a broad mission to address the rising need for strategic narrative assessment as a tool for promoting cooperative assistance and creating community power. For more information on the MESA Group, visit https://mesagroup.okstate.edu.

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ACRONYMS

API	Application Programming Interface
CNN	Cable News Network
HBM	Health Belief Model
ICU	Intensive Care Unit
JSON	Java Script Object Notation
MESA	Media Ecology and Strategic Analysis
MTurk	Amazon Mechanical Turk
NLP	Natural Language Processor
NT	Northern Triangle
OSU	Oklahoma State University
US	United States
VCF	Vaccine Confidence Fund

EXECUTIVE SUMMARY

Because of the disproportionate impact of COVID-19 among marginalized migrant populations and the lack of research on vaccine confidence among these populations, this project sought to trace organic discussions of vaccine confidence within Hispanic communities and to use these discussions to develop empirically validated messaging to bolster vaccine confidence and uptake. In doing so, the study had two aims: First, give voice to Hispanic communities' discussion of COVID-19 vaccination by conducting in-depth interviews capturing their personal stories, attitudes, and beliefs about COVID-19; targeted qualitative analysis of Hispanic communities' expression of COVID-19 confidence within Hispanic Facebook groups; and broader exploration of Hispanic communities' discourse about COVID-19 through machine learning analysis on Facebook. Second, we then used the organically emergent narrative themes to craft messages promoting vaccine confidence and experimentally validated them through an online survey. Taken together, our project's novel methodology and empirical findings demonstrate the effectiveness of identifying culturally situated discourses as a means to amplify organic community narratives to boost vaccine confidence.

Interview results found the following themes:
→ Expressions of vaccine confidence arising from: caring for the community, death narratives/fear, caring for immediate family, living more, vaccine as a benefit, vaccine providing protection, no cost or financial incentive, work/school requirement, surviving COVID once, vaccine safety.
→ Expressions of vaccine hesitancy arising from: government control, "created" virus, vaccine side effects, vaccines as not necessary/COVID not serious, difference in vaccines, fertility issues, virus in the vaccine, rushed vaccine, "Hispanics" way of thinking.

Social media analyses found:
→ Vaccine confidence themes to primarily include the following: vaccines provide protection/not being at risk, vaccine safety and effectiveness, preventing death, minimal/no side effects, concern for the family, danger/fear of unvaccinated, COVID vaccine's similarity to other vaccines/historical comparisons, responsibility narrative, risk/benefits analysis, belief in science, concerns for the community, overcrowded hospitals/protecting medical workers, war on COVID/end of pandemic, double standards for anti-vaxxers, vaccine saving lives/miracle, return to normal, minorities disproportionately affected.
→ Broader trends of Hispanic discussions on Facebook. AI takeaways include high volumes of spam content on group pages, disproportionate voice among top users, more neutral sentiment on information focused groups, religious associations and mention of the vaccine's cost.

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Survey results found:

→ Culturally specific narratives significantly increased COVID-19 vaccine confidence relative to generic messaging above and beyond the effect of a variety of perceptions related to the COVID-19 vaccine.

→ Hispanic participants significantly preferred social media pages featuring Hispanics in the Facebook Group's image than non-Hispanics.

→ Partial support for the persuasive impact of culturally tailored messages relative to generic messaging.

→ A significant interaction effect between perceived susceptibility and narrative type on COVID-19 vaccine confidence. Those perceiving their own susceptibility to COVID-19 led to greater confidence in COVID-19 vaccination, with this association stronger among those exposed to culturally specific narratives than those exposed to generic narratives; while COVID-19 vaccine confidence was lowest among individuals exposed to generic narrative with lower perceived susceptibility.

Contributions

This project contributes to the academic literature by:

→ addressing the lack of research into historically marginalized communities' values, attitudes, and beliefs about COVID-19;

→ focusing on vaccine confidence rather than anti-vaccine content and vaccine hesitancy;

→ exploring community-driven narratives as a resource to construct narratively informed messaging strategies to boost expressions of vaccine confidence;

→ addressing the role of imaging and native language within Facebook groups as a means to bolster Hispanic communities' trust and information seeking related to COVID-19.

CHAPTER 1 | INTRODUCTION

Background and Rationale

Vaccine confidence refers to a wider trust in the vaccine product, health provider, and policy-makers who decide on vaccine provisions (Larson, Schulz, Tucker, & Smith, 2015). Public vaccination confidence is vital to the success of COVID-19 vaccine programs and other routine immunizations (Chou & Budenz, 2020). Yet, building public confidence in COVID-19 vaccination has been inherently challenging. The novelty of the vaccine, expedited development process, and ever-changing vaccine-related information have exacerbated concerns over the safety and efficacy of COVID-19 vaccines; making it difficult to foster vaccine confidence (Jordan, Yoeli, & Rand, 2020).

One way to increase vaccine confidence and uptake is to leverage social media. Though much maligned for its role in the spread of disinformation (Broniatowski et al., 2018; Larson, 2018; Mbaeyi, Cohn, & Messonnier, 2020), social media nevertheless provides direct channel communication with individuals and communities about vaccination and public health. Further, digital detection strategies within social media platforms offer real-time evaluation of narratives indicative of both vaccine hesitancy and confidence (Wilson, Atkinson, & Deeks, 2014). Social media undeniably binds and builds communities in ways otherwise inaccessible, offering ability and equality of voice through open public discourse.

While existing research suggests exposure to vaccine content on social media influences opinions and sentiments toward vaccination (Puri, Coomes, Haghbayan, & Gunaratne, 2020), important gaps in understanding how these influences operate remain:

1. The body of the literature on social media vaccination discourse predominantly focuses on general social media users (Cinelli et al., 2020), with considerably fewer studies on historically marginalized or excluded communities; whose populations are at higher risk for severe illness and death when contracting the virus (Caron & Adegboye, 2021). Research is needed on marginalized populations with low vaccination uptake and how these populations express vaccine confidence/hesitancy on social media.

2. Second, while vaccine confidence is inherently narrative driven, as the foregrounding rationale for trust is based on an individual's sequencing of characters, motives, and outcomes in ways intelligible and coalescive of attitudes, few studies have examined the role of narratives on social media relevant to vaccine confidence.

3. Finally, despite the potential of social media as a tool to improve vaccine confidence,

research, to date, has focused almost exclusively on anti-vaccine content and vaccine hesitancy.

This research project addresses these three gaps.

Health crises in migrant communities are exacerbated by lack of established trust with state authorities, few means of communicating public sector information, and minimal healthcare access (Bhopal, 2020). Research shows undocumented migrants are more reluctant to seek vaccination and experience disproportionate deaths and reported cases (Hayward et al., 2021). The dire circumstances facing undocumented migrants during COVID-19 are described as an "urgent international endeavor" (Teerawattananon, Teo, Lim, Hsu, & Dabak, 2021, p. 1).

While low vaccine confidence among migrants in the US has links to structural constraints, narratives expressive of vaccine confidence may alleviate socially derived constraints by amplifying trust in public health resources. Research on COVID-19 vaccine reluctance among migrants notes many issues could be addressed with information campaigns co-produced and delivered by sources within marginalized communities (Deal et al., 2021). Therefore, **identifying and amplifying narratives expressive of vaccine confidence within communities with low vaccination uptake is a means of both expanding intellectual public health and facilitating trust.**

To achieve this, we utilize a novel mixed-methods approach focused on algorithmically identifying narratives of vaccine confidence within online migrant communities, assessing narrative features, and validating those features with migrant group interviews.

Hypotheses and Research Questions

Language and image preferences

Hypothesis 1:

Hispanic participants are more likely to prefer social media pages featuring Hispanics in the image and Spanish language than non-Hispanic participants.

Hypothesis 2:

Hispanic participants are less likely to prefer social media pages featuring non-Hispanics in the image and English language than non-Hispanic participants.

Hypothesis 3:

Hispanic participants are more likely to prefer social media pages featuring Hispanics in the image and Spanish language than social media pages featuring with Hispanics in the image and English, non-Hispanic in image and Spanish, and non-Hispanic in the image and English.

Hypothesis 4:

Hispanic participants are less likely to prefer social media pages featuring non-Hispanics in the image and English than social media pages featuring Hispanics in the image and Spanish, Hispanics in the image and English, and non-Hispanics in the image and Spanish.

Persuasive messaging preferences

Hypothesis 5:

Hispanic participants are more likely to prefer tailored persuasive messages curated from Hispanic social media and interview data than generic messages from government health sources concerning COVID-19 vaccination.

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Narrative element preferences

Hypothesis 6:

Hispanic migrants who are exposed to culturally tailored narratives are more likely to express COVID-19 vaccine confidence than Hispanic migrants who are exposed to generic narratives, above and beyond the well-documented effect of a variety of perceptions related to the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects).

Research Question 1:

How does each participant's perception of the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects) relate to COVID-19 vaccine confidence?

Research Question 2:

How does each participant's perception of the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects) interact with message type (i.e., culturally tailored narrative vs. generic narrative)?

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CHAPTER 2 | LITERATURE REVIEW

Defining Marginalized Hispanic Migrant Communities in the US

The Hispanic community is currently one of the largest growing minority populations living in the United States (Do & Matsuyama, 2014). In 2020, the Census Bureau stated that 19% of the U.S. population were made up of Hispanics (approximately 62 million) (M. H. Lopez, Krogstad, & Passel, 2021). Mexicans represent the largest origin group in the US, at nearly 37 million (Noe-Bustamante, 2019). Migrants from the Northern Triangle (NT), comprised of El Salvador, Guatemala and Honduras, constituted the fastest growing US immigrant populations between 2007-2015, rising about 25% (Cohn, Passel, & Gonzalez-Barrera, 2017). Political insecurity, gang violence, and poor economic conditions are among key factors driving this migration (Congressional Research Service, 2021; MESA, 2021). Due to complicated legal processes, they tend to turn to human smugglers for help that puts them at risk of kidnapping and sexual assault (Cooley, Hinck, & Sample, 2020).

While Hispanic migrants have historically congregated in large cities along the East and West coasts, new waves of immigrants have begun to settle in the Midwest and Southeast (R. C. Cervantes, Gattamorta, & Berger-Cardoso, 2019). Hispanic migrants are less likely to have graduated from high school than their native-born counterparts, and more likely to work in service occupations and live in poverty (Derose, Escarce, & Lurie, 2007).

Documentation status can exacerbate this disparity, having major impacts on immigrants' access to education, work, healthcare, and legal resources. It is estimated that there are 11,430,000 undocumented migrants living in the US, 59 percent of which are from Mexico, and 14 percent from the NT (Quijada & Sierra, 2019).

Culturally, Hispanic migrants bring with them an emphasis on family values, respect, and social harmony (Ruiz, Sbarra, & Steffen, 2018). Studies show that immigrants adopt a "bi-focality" between the cultural values of their country of origin and their host culture: "aspects of life 'here and life 'there' – whether perceived from the migrant's starting or destination point – are constantly monitored and perceived as complementary aspects of a single space of experience" (Vertovec, 2004, p. 970). This bi-focality often manifests in the development of transnational communities, in which immigrants develop social and economic ties between both their host community and country of origin (Galstyan & Galstyan, 2021). In the US, Hispanic nationals from different countries may experience different transnational practices and acculturation stressors depending on their country of origin. For example, Mexican immigrants were found to have higher acculturation stress than other Hispanic immigrant populations, possibly due to recent changes in immigration policy and enforcement in the Southwest where many Mexican immigrants reside (R. C. Cervantes et al., 2019). Salvadorians (as well as other NT migrants) tend to have a more vulnerable legal position which may prevent

participation in transnational practices such as international travel (Bravo, 2017) and increase acculturation stress (Murphree, 2016).

The COVID-19 pandemic has impacted immigrant transnational practices. Transnationalism has affected pandemic coping strategies of both migrants and non-migrants through the transfer of ideas, beliefs, and practices related to pandemic regulations, personal health practices, and trust in local authorities (Galstyan & Galstyan, 2021). Conversely, pandemic-related practices have impacted transnationalism through lockdowns, travel restrictions, and social distancing which impact the ability of migrants to travel to their country of origin as well as participation in their local transnational community (Nehring & Hu, 2022). Due to COVID-19, migrants are increasingly developing transnational connections through social media and internet technologies (Jauhiainen, Özçürümez, & Tursun, 2021); as these groups are more practically accessible and relied upon.

COVID-19 Impact on Marginalized Hispanics' Health Outcomes

COVID-19 has undoubtedly affected Hispanic migrant communities' health. We are to consider social determinants of health such as employment, socioeconomic status, age, and race as important factors when assessing a communities' access to healthcare. Hispanic migrants are both at a higher risk for contracting COVID-19 as well as having particular vulnerabilities inhibiting their care and recovery. Thus far, Hispanics have been more likely to contract COVID-19 (Calo, Murray, Francis, Bermudez, & Kraschnewski, 2020) and die from the disease (Yoch, 2021) compared to other racial or ethnic communities. Hispanic migrants are more likely to be frontline workers, live in multigenerational housing, live in larger cities, and have less access to health care, all of which increase the risk of contracting COVID-19 (Blau, Koebe, & Meyerhofer, 2021; Velasquez, Uppal, & Perez, 2020).

At the start of the pandemic, 60% of Hispanic workers were classified as frontline workers, while other groups averaged 41% (Clark, Fredricksid, Woc-Colburn, Bottazzi, & Weatherheadid, 2020). Throughout the course of the pandemic, Hispanic workers have been more likely to experience job loss in frontline positions relative to other groups (Clark et al., 2020). The loss of employment often leads to the loss of health insurance benefits at the same time, and the lack of health insurance often leads to poor health outcomes (Shiro & Reeves, 2020). Hispanics are often considered to be one of the highest populations of uninsured, and almost half of Hispanic immigrants do not have health insurance (Krogstand & Lopez, 2014).

Almost 30 percent of Hispanic immigrants live in multigenerational housing, thus increasing the risk of exposure and transmission to elderly or immunocompromised family members (Clark et al., 2020). The burden of COVID-19 has been compounded for noncitizens, their families, and communities. Hispanic adults, in families with noncitizens, have experienced unemployment at higher rates than families in which all members are citizens (Gonzalez, Karpman, Kenney, & Zuckerman, 2020). For example, researchers found that in Massachusetts, one of the strongest predictors of the burden of COVID-19 cases within a community is the proportion of foreign-born noncitizens (Figueroa, Wadhera, Lee, Yeh, & Sommers, 2020). Noncitizens are less likely to have health insurance and less likely to speak English, which operate as barriers for noncitizens to receive medical attention (Derose et al., 2007). The language barrier is often associated with lower health literacy rates (Kricorian, Civen, & Equils, 2021) and worse health outcomes (Derose et al., 2007). Additionally, limited English proficiency has been shown to negatively affect the trust between patient and provider (Levison, Levinson, & Alegría, 2018). Some researchers found that Hispanics are also less likely to seek out and follow health treatment plans due to cultural stigma (Garcini, Pham, Ambriz, Lill, & Tsevat, 2021; Levison et al., 2017; V. Lopez, Sanchez, Killian, & Eghaneyan, 2018).

A compounding factor is that Hispanic migrants tend to mistrust healthcare systems and government authorities in general. This, combined with the

current misinformation environment, has resulted in worse healthcare outcomes in Hispanic communities. Hispanics have been reported to have higher levels of COVID-19 misinformation and vaccine hesitancy compared to other groups (Druckman et al., 2021). Misinformation and fear among Hispanic immigrants can be exacerbated by the transnational relationships of immigrants. Fear stemming from the policies or poor outcomes in their country of origin has impacted immigrants' trust in the US system and COVID-19 policies (Migrant Clinicians Network, 2021). Fear of deportation was also a high concern for undocumented immigrants, especially when interacting with health and social services (Callaghan et al., 2019), and this fear was exacerbated during Trump-era policy changes (Gonzalez-Barrera & Lopez, 2020). Many undocumented immigrants reported fearing the information collected during vaccine appointments would be used to contact immigration authorities (McFadden et al., 2022). The fear of deportation has also created a reluctance for migrants to come forward for testing or contact tracing thus resulting in further spread of COVID-19 to Hispanic communities (Guadagno, 2020).

Misinformation circulation is also a factor pushing the fear of deportation. Interviews with Hispanic participants revealed a sentiment that COVID-19 is an invented disease by the US government to track down on migrants and deport them when they are seeking healthcare (L. Cervantes et al., 2021). Another documented misconception is that there are implanted tracking devices (or microchips) inserted during vaccination (Garcia, Vargas, de la Torre, Magana Alvarez, & Clark, 2021).

Vaccine Confidence of Marginalized Hispanics

Vaccine confidence refers to a wider trust in the vaccine product, health provider, and policymakers who decide on vaccine provisions (Larson et al., 2015). Public vaccination confidence is vital to the success of COVID-19 vaccine programs and other routine immunizations (Chou & Budenz, 2020). Yet, building public confidence in COVID-19 vaccination has been inherently challenging. The novelty of the vaccine, expedited development

process, and ever-changing vaccine-related information have exacerbated concerns over the safety and efficacy of COVID-19 vaccines; making it difficult to foster vaccine confidence (Jordan et al., 2020).

There is a lack of research into what motivates vaccine confidence and uptake within Hispanic migrant communities. This is an important issue, as public service announcements and other messaging campaigns play an important role in vaccine uptake and confidence in the general population. The gap in this messaging towards Hispanic migrants poses risks not just to the health and safety of migrants themselves, but to their surrounding communities and economies.

Both Hispanic populations in major US cities and Hispanic populations in majority-minority counties have been disproportionately affected by COVID-19. Transmission, in general, is higher in urban areas due to population density (Andersen, Harden, Sugg, Runkle, & Lundquist, 2021). Therefore, health officials have highlighted the importance of vaccines for urban populations (Murthy et al., 2021). As Hispanic communities continue to grow in size (Schaeffer, 2019), vaccine uptake among this population will be critical to preventing the spread of COVID-19.

Many members of the Hispanic community have fulfilled vital roles in their communities during the COVID-19 pandemic, working as frontline workers. Jobs classified as frontline carry a higher risk of COVID-19 exposure but are essential to the continuing function of the US economy. Throughout the pandemic, shortfalls in frontline workers have caused supply chain issues, delays in service, and increased cost of production (Levenson, 2022). The mental and physical toll on the frontline workers themselves cannot be understated (Kavanagh, Pare, & Pontus, 2020). Therefore, the vaccination of frontline workers has been stressed by US health officials (Dooling et al., 2021). Vaccine uptake rates among frontline workers will be heavily influenced by Hispanic frontline workers.

Vaccine Confidence Communications

One way to increase vaccine confidence and uptake is to leverage social media. Though much maligned for its role in the spread of disinformation (Broniatowski et al., 2018; Larson, 2018; Mbaeyi et al., 2020), social media nevertheless provides direct channel of communication with individuals and communities about vaccination and public health. Social media undeniably binds and builds communities in ways otherwise inaccessible, offering ability and equality of voice through open public discourse. Traditionally, health communication and messaging has focused on presenting logical arguments, data, and facts (Lee, Fawcett, & DeMarco, 2016). However, these strategies are less effective in communicating health information to nonexpert audiences (Dahlstrom, 2014). **One way of leveraging social media for health communication purposes is through the use of narratives as a messaging strategy.**

Vaccine confidence is inherently narrative driven, as the foregrounding rationale for trust is based on an individual's sequencing of characters, motives, and outcomes in ways intelligible and coalescive of attitudes. While low vaccine confidence among migrants in the US has links to structural constraints, narratives expressive of vaccine confidence may alleviate socially derived constraints by amplifying trust in public health resources. Research on COVID-19 vaccine reluctance among migrants notes many issues could be addressed with information campaigns co-produced and delivered by sources within marginalized communities (Deal et al., 2021). Therefore, identifying and amplifying narratives expressive of vaccine confidence within communities with low vaccination uptake is a means of both expanding intellectual public health and facilitating trust. We now turn to the discussion of narrative theory in general.

Narrative theory

Human beings rely on narratives to understand the world and their place in it (Fisher, 1984). Narratives are not individual, they are formed and reinforced by the communities in which we find ourselves (Aiken,

2019). Narratives have the ability to elicit action, putting forth standards to define good and bad actions (Cooley et al., 2020; MacIntyre, 2007). By framing current events in a trajectory of history, narratives offer structure during uncertain times, a guide for action, and a promise of alternative futures (Wittmayer et al., 2019). It is through narrative framing that humans imagine, deliberate, and decide which actions will bring about or hinder a specific future (Wittmayer et al., 2019). Through communication technologies, narratives have the power to influence others' actions. This power has increased due to the ubiquity of social media and internet communication.

Narrative's power lies in its ability to allow audiences to be transported into a narrative world. When it comes to health communications, this ability distinguishes narrative processing from persuasive massaging (Frank, Murphy, Chatterjee, Moran, & Baezconde-Garbanati, 2015), and the transportation encourages the adoption of the beliefs conveyed in the narrative (Green & Brock, 2000). Narratives are also exceptional at carrying and creating emotion, and emotional narratives improve audience engagement, attention, and information retention (Sangalang, Ophir, & Cappella, 2019).

In order to create effective narratives, it is important to consider the identity, language, and culture of the target audience. The degree to which audiences are able to identify with a character in the narrative increases fidelity and transportation. Similar self-image between characters and audiences increases the degree to which viewers are able to identify with narrative characters, as well as their reactivity and transportation (Neil et al., 2019). Identifying with a character in the narrative increases the ability of the viewer to imagine themselves doing, thinking, or feeling something they ordinarily would not (Cohen, 2001). Language also affects audiences' abilities to identify and adopt narratives. Comprehension, transportation, and identification are increased when media is presented in the audience's native language (Hobelman, 2015). This is critical for reaching minority communities, specifically the Spanish-speaking population within the US.

Narratives and marginalized Hispanics

Studies have shown that narratives are an effective tool in health promotion among minority communities with strong storytelling traditions (specifically African American and Hispanic communities) (Lee et al., 2016). They are effective because they can encapsulate cultural elements that have potential to reach the "minds and hearts" of a particular group and elicit behavioral change (Larkey & Hecht, 2010, p. 115). For narratives to be effective in a minority group, that narrative must have fidelity within that particular culture. Fidelity is built through references to that group's cultural values, racial/ethnic identity, religiosity, and cultural myths (Larkey & Hecht, 2010). Moreover, these narratives are most effective when they are created from the experiences of the group members rather than adapted to them (Larkey & Hecht, 2010). This builds coherency for the audience, as the narrative comes across as more authentic.

Content form of narratives may play an important role in vaccine uptake among Hispanics. Health information relayed through novellas, for example, has been shown to be an effective health promotion strategy across Latin America (Kepka, Coronado, Rodriguez, & Thompson, 2011). One study created a radionovela highlighting the importance of HPV vaccination (Kepka et al., 2011). The narrative placed within the familiar form of a novella was shown to increase HPV vaccination interest among Hispanic parents with lower levels of literacy and English proficiency (Kepka et al., 2011). Another study found that fotonovelas are effective health promotion strategies among Hispanic communities, especially among low-literacy audiences (Chan, Brown, Sepulveda, & Teran-Clayton, 2015).

Literature on narrative health promotion among minority populations highlights the importance of community-centric narrative development. This allows the creators of the narrative to address concerns and hesitancy that exist in particular minority groups. An initial understanding of the causes of hesitancy is needed in order to form a narrative that addresses these hesitations. Health promotion narratives should aim to increase the audience's perceptions of illness susceptibility, illness severity, and the benefits of vaccination (Chan et al., 2015). Narrative tools such as community-relevant stories (coherence) and character identification (fidelity) can be used in health promotion campaigns to increase minority uptake (Chan et al., 2015). A strong protagonist with whom the audience can identify increases self-efficacy among audience members (Chan et al., 2015). Thus, community-centric and culturally-competent narratives offer effective ways to reach marginalized populations and increase vaccine confidence and uptake (Chiu, 2009).

CHAPTER 3 | METHODOLOGY

To test the study's hypotheses and answer the research questions, an interdisciplinary mixed-method design was conducted with experts in online health communication, systems theory, narrative analysis, field research, and prior work experience with migrant communities on funded research projects.

The research design included three phases: in-depth interviews with migrant community members, social media analyses of migrant community posts, and an online survey designed to test the effectiveness of identified vaccine confidence narratives, persuasive messages, and preferred messengers.

In-Depth Interviews

In-depth interviews were conducted with the Hispanic migrant community of Stillwater, Oklahoma, and surrounding areas. A total of 9 interviews were completed for the study. The interviews were conducted between October 21 and December 16, 2021. Interviews lasted between 18 and 26 minutes. The purpose of the interviews was to identify and validate key features of expressions of vaccine confidence in narratives and cross reference those findings to the social media data findings. Interviews focused on understanding the underlying factors behind the resonance of specific vaccine confidence narrative features, as well as identifying community-based information sources, perceived obstacles of access, trust related to government and healthcare services, as well reliance on social media

in promulgation of vaccine confidence narratives. The final interview question list is included in Appendix A. Interviews were conducted in Spanish over Zoom with the entire session recorded. Interviews were then transcribed, translated into English, and thematically coded by one researcher and two research assistants.

Social Media Analyses

First, researchers used pilot keywords, including "COVID," "COVID-19," "hispano," "inmigrante" and "vacuna," to identify publicly accessible Facebook group pages discussing COVID-19 vaccination. The resulting Facebook group pages were then manually examined for attributes affirming geo-locations (e.g. specified community focus of page, tagged locations of members, tagged location of posts, etc..), predominate usage of the Spanish language, level of user engagement (at least one post per month required), content predominantly focused on COVID-19 vaccination (at least six of the first ten posts directly mentioning the vaccine), number of page subscribers (n=100 as minimum). A total of six trained coders (two faculty members and four research assistants) undertook this screening process, yielding a combined total of thirty-eight unique Facebook group pages matching the criteria. These groups coalesced into four broad categories (U.S.-based Hispanic communities (n=10), transnational Hispanic communities (n=16), US-based Hispanic news and health information services (n=4), US Hispanic migrant origin nation

communities (n=8) (See Table 3.1). US-based Hispanic communities were geo-located in the US either by the title of the group or within the group location feature. Transnational Hispanic communities were defined as not bound by a geo-location. While nationality varied considerably for each member, at least some members of the group were geo-located in the US. US-based Hispanic news and health information services were group pages offered by municipalities or news services to specifically reach the Hispanic speaking populations in specific US locations concerning COVID-19 vaccination. Hispanic migrant origin nation communities were high volume groups from locations specific to the US migrant population as origin countries (i.e., Mexico, Guatemala, El Salvador, and Honduras).

Quantitative social media analysis

All comments posted to a purposely selected ten of the thirty-eight identified Facebook group pages were collected using an adapted script similar to Facebook Graph API, allowing the extraction of data from within the Facebook group pages (i.e., post date, post author, post 'likes' (no distinction between various reactions and likes (e.g. emojis, hearts, etc..), post content, and post comments). Posts were then mined by building scripts leveraging the Python programming language. The ten purposely selected groups were chosen for the data mining because they offered a high volume of relevant content and contrasting positions on COVID-19 vaccination. Posts, comments, and other pertinent information were then imported using HTML parsing and mined using various Natural Language Processing (NLP) methodologies and machine learning algorithms.

A date range was set from August 2021 through December 2021 to reduce the amount of content to a manageable size given the high volume. Further analysis of the initial data demonstrated that although the amount of content was high, the level of user-to-user engagement was relatively low. A visual inspection showed that the spam post to actual user post ratio was as high as 10 to 1 in some groups. To narrow the focus to posts with some level of actual user engagement, a determination was made to only keep posts with 5 comments or more in the dataset. This would provide a minimum level of engagement from users on a particular post and eliminate the vast majority of the spam posts from the dataset. Extraction of data from comments included date, author, number of reactions the comment received (no distinction made between the different types of reactions such as hearts, likes and emojis), and the actual comment text. K-means modeling, cluster analyses, human in the loop sentiment analysis, and Spanish language emotive indexes were employed across the extracted data.

Through the course of the manual Facebook group page identification, researchers noted three potential limitations:

1. The disproportionate ratio of negative comments expressive of vaccine hesitancy and misinformation to that of expressions of confidence in the vaccine.
2. Researchers noted the posts on Facebook group pages were more personally positional or geared toward information seeking, rather than directly discursive with other community members about the vaccine. This, in part, because many such groups exist to document personal reactions to the vaccine or to help individuals already wishing to get vaccinated locate a site offering COVID-19 vaccination.
3. The HTML parsing could not target specific post-based keywords to filter more relevant or likely expressions of vaccine confidence.

These three limitations were accounted through the qualitative social media analysis.

Qualitative social media analysis

To account for the disproportionate ratio of negative comments and post-based keyword restrictions, researchers examined all thirty-eight identified sites manually. Pilot keywords, including "COVID," "COVID-19," and "vacuna" were used to search available posts and comments across each of the Facebook group pages; the keyword "vacuna" was decided upon given the more precise relevance of

Table 3.1
Facebook groups included in the study

Group Name	Group Size
Transnational Groups	
Información del COVID-19	24,973
No a la Vacuna	1,836
Reacción de la vacuna Pfizer Gto Capital	1,161
Embarazadas con y sin COVID-19	1,147
Vacuna COVID-19	6,889
Quiero vacunarme, pero con la Sputnik V	1,437
Secuelas COVID 19	5,562
La vida despues del COVID	1,126
Yo no me vacuno y voy sin mascarilla!!!	562
Anti Vacuna	275
Vacunas Sinovac	3,663
sobreviviendo después del COVID	456
Anti vacunas !!	1,595
Sin olfactory sin gusto- sin to a COVID 19	17,777
Contagiados de COVID 19	6,289
COVID 19 consejos y experiencias	549
US Hispanic Groups	
Información sobre la vacuna COVID de Florida	5,053
Información sobre la vacuna COVID19	364
Find a COVID shot WA (Share with Friends)	816
Yo me vacuné	816
Hispanic/Latino VACCINE INFORMATION	809
Ask Clila- Coalición De Líderes Latinos	12,000
Filas de vacunas Nuevo Laredo (niños)	294
Sobrevivientes de COVID19	4,841
Immigrant Workers and Families Affected by Coronavirus in NYC	1,300
GRUPO New Jersey COVID19 Info y Vacunas	249
US News and Health Services for Hispanics	
Houston together against the coronavirus	5,900
COVID-19 SMA	4,641
COVID 19 in Spanish Utah information	979
Informacion Battle Creek COVID-19 en Español	149
Migrant Origin Country Groups	
Vacuna COVID-19 Guatemala	8,461
Vacunas y Vacunación COVID-19 México Ⓜ Ⓧ	39,148
Vacunacion COVID Mexicali	4,667
Brigada Correcaminos de COVID	25,198
Cuidemos del COVID 19 -Consejos, Noticias, y Ofertas	6,853
Campanas de vacunacion	3,976
vacunacion COVID 18 a 39	9,370
Consegui tu vacuna contra el COVID-19 Guatemala	78,900

posts to expressions of vaccine confidence over the other two terms. The selected account pages were then searched across for posts using the keyword "vacuna." From the available posts resulting from the keyword search, the top twenty most commented on posts were selected for each of the account pages. The user comments for each post were examined by researchers manually in order to locate and extract expressions of vaccine confidence. Expressions of vaccine confidence were considered as positively mentioning COVID-19 vaccines, the science behind them, and/or providing persuasive reasonings concerning vaccination as a decision. The reliance on human researchers offered greater contextual examination of the data; though subjective in nature, researchers errored toward exclusion rather than inclusion of expressions of vaccine confidence. Across the thirty-eight groups the selected posts yielded 1388 comments, of which 130 were expressive of vaccine confidence.

To account for the adapted API's inability to target specific post-based keywords to filter more relevant or likely expressions of vaccine confidence and Facebook group pages being composed largely of personal-positional or information seeking statements; researchers conducted a second manual extraction of data from Facebook. Facebook news pages in Spanish were found to generate more conversational-topic based posts, with audiences commenting on the posted news story and among themselves concerning it. Further, news pages in Spanish are part of larger local and national news media outlets with physical infrastructure that can be readily geo-located in the US. See Table 3.2 for a list of Facebook news sites included in this study.

Researchers identified the major Spanish language television networks in the US based on percentage of households reached and number of viewers (i.e., Univision, Telemundo, UniMas, Azteca), as well as specialty news networks such as CNN en Espanol and Universo. These networks were cross-referenced on Facebook for available account pages.

Table 3.2
Facebook news sites included in the study

Type	Category	Name	Expressions of Vaccine Confidence Identified
News	Local	Noticias 45 Houston	36
News	Local	Telemundo OK	2
News	Local	Univision SATX	17
News	Local	Univision Arizona	1
News	Local	Telemundo 40	9
Entertainment	National	Estrella TV Network	1
News	National	CNNee	39
Entertainment	National	NBC Universo	1
News	National	Remezcla	9
News	National	NBC Latino	6
News	National	Confidencial	32
News	Local	Univision NY	19
News	Local	Telemundo 62	6
News	Local	LaOpinion LA	3
News	National	Digital Trends en Espanol	1
News	Local	Aldia Dallas	25
News	Local	Univision San Diego	4
Entertainment	National	TVy Novelas US	5
News	National	Hoy Dia Telemundo	13
News	Local	Fuerza Tulsa	3
News	Local	NY1 Noticas	10

Additionally, given that Hispanic migrant populations are likely to rely on local, Spanish language news channels, along with national news providers, for information researchers identified available Facebook account pages for local Spanish-language news providers in cities with the large Hispanic television markets in the US (i.e. San Diego, Dallas, Houston, New York City, Los Angeles, Orlando) as well as in cities in regional proximity to the migrants interviewed for the project (i.e. Tulsa and Oklahoma City). Finally, given the prevalence of entertainment news consumption among Hispanic migrant community researchers included major US-based Spanish-language entertainment news Facebook account pages (i.e., Estrella TV, TVyNovelas, NBCUniverso); this was done to include a more diverse and generalized Hispanic migrant population in terms of age, education, and political identification as entertainment news consumers are generally differentiated from hard news consumers as such. From this process, a list of twenty-one US-based, Spanish-language networks with available Facebook account pages were identified; nineteen of the network pages were categorized as news sites (12 local news site pages, and 6 national news site pages), three of the pages were categorized as entertainment sites (all of which were national site pages).

As before, pilot keywords, including "COVID," "COVID-19," and "vacuna" were used to search available posts and comments across each of the 21 Facebook account pages; again, the keyword "vacuna" was decided upon given the more precise relevance of posts to expressions of vaccine confidence over the other two terms. The selected account pages were then searched across for posts using the keyword "vacuna." From the available posts resulting from the keyword search, the top ten most commented on posts were selected for each of the account pages. These posts were then sort filtered according to relevance, populating the comments with the most reactions (i.e., likes) and replies. Researchers then evaluated the top twenty most reacted to comments for expressions of vaccine confidence (viz. stated pro-vaccination arguments/ positions). Researchers examined 33,417 Facebook news site comments, selecting a total of 242 representing expressions of vaccine confidence.

All manually extracted Facebook data was then qualitatively assessed by four research team members using a thematic narrative analysis approach guided by Fisher's narrative paradigm (i.e., assessing narrative coherence, fidelity, as well associated actors, agents, instruments, scenes and purposes of action). The analysis focused on the interactions of key features within narratives of vaccine confidence to those expressive of vaccine hesitancy. Researchers thematically categorized and condensed data following a two-step process; where themes are found individually by each coder as step one, then cross-referenced and organized across one another as step two.

Experimental Survey

Finally, an online experimental survey examining Hispanic migrant community preference for expressions of vaccine confidence designed around findings from interview and social media data against control group populations was conducted using Qualtrics and MTurk platforms. Treatments manipulated message delivery imagery around ethnicity, as well as narrative manipulations customized to Hispanic migrant community expressions of vaccine confidence. Hispanic treatment messages highlighted cultural collectivism, community responsibility, apprehension of government, logistical costs, and conspiracy theory prevalence as primary contrast to generic messages. Hispanic treatment images featured Hispanic models, while generic control images featured non-Hispanic models.

To create persuasive Hispanic-catered expressions of vaccine confidence, researchers used both thematic findings as well as portions of direct mined social media comment compositions to craft statements. In total, sixteen expressions of tailored vaccine confidence were produced focusing on important themes from the data concerning COVID-19 vaccination (e.g., return to normalcy, social responsibility, absorbing risk for protection, obligation to work and family, collectivism, mistrust

of government, expense, etc.). These statements were set in contrast to generic control statements issued by the CDC and other health organizations on similar topics or focus points related to COVID-19 vaccination. See Appendix B for the survey instrument.

Similarly, researchers used thematic findings from social media and interview data to create treatments differing in message deliverer. Interviewees were asked specifically during the in-depth interview portion of the study about their preferences for media and messengers in relation to trustworthiness and preference in learning about COVID-19 vaccination. From the responses, apprehension toward government messengers and complex government facilities was indicated, as was a preference for unbiased health care workers to give information about the vaccine. Images were manipulated to alter the inclusion of Hispanic persons in contrast to control images of Caucasians and African Americans focusing on children, patient-doctor, elderly, and vaccine clinic. Participants were asked to examine eight curated Facebook group pages for the purpose of helping schedule the COVID-19 vaccine. Participants were asked to assume they needed some help related to the COVID-19 vaccine, irrespective of their actual vaccination status. Participants were then asked to rank-order the most convenient place for them to get vaccinated and learn more information about the COVID-19 vaccine.

Hispanic participants were shown either a customized Hispanic narrative with an accompanying image of a Hispanic person representing the character in the narrative or shown a generic narrative with an accompanying generic image of a Caucasian representing the character. Non-Hispanic participants were shown either a generic narrative with an accompanying generic image of a Caucasian representing the character, or a non-narrative bullet point series of science-based COVID-19 vaccine information with no accompanying image. Participants were then asked to respond to the vaccine confidence measurements. See Appendix B for the survey instrument.

CHAPTER 4 | INTERVIEW FINDINGS

Summary of Interview Findings

Interviews with migrants were organized around three topics: vaccine confidence narratives, vaccine hesitancy narratives, and barriers to vaccination. Two dominant vaccine confidence narratives emerge: caring for the community and death/fear narratives. Many interviewees highlighted the importance of getting vaccinated in order to better protect and care for others. Fear of death narratives encompassed sentiments that the vaccine was effective in preventing death from COVID-19. These two narratives were the most frequently mentioned in migrant interviews expressing vaccine confidence. At the intersection of these two themes is the "caring for one's immediate family" narrative. Migrants express concern both for passing on the virus to family members, as well as they themselves dying and leaving their families without support. Among the least frequently mentioned vaccine confidence narratives were: surviving COVID once, work/school requirement, and vaccine safety.

Of the narratives related to vaccine hesitancy present in migrant interviews, the most commonly mentioned were related to government control and the virus being "created." Frequently mentioned within the category of government control were statements purporting the vaccine would insert a chip or control the mind of the recipient, or that the vaccine could be used by the government as a form

of population control. Also, common among interviewees expressing vaccine hesitancy is the theme of the virus being created. These participants expressed either the sentiment that the virus was created in a lab or that the virus was fictitious and did not exist at all.

Three narratives emerged illustrating the barriers to vaccination experienced by the Hispanic migrant community: language, access to doctors, and fear. Language is the most frequently cited barrier to vaccination. Migrants convey experiences of delay, inefficiencies, and even neglect from health officials stemming from the language barrier. Access to doctors was also a problem expressed by migrants. Access to doctors was explained as a barrier to vaccination, affecting their access to information. Interviewees also expressed not having the time to make appointments. Fear was also a barrier to vaccination for migrants. Fear as a barrier to vaccination, distinct from fear of death expressed in vaccine confidence narratives, reflects sentiments relating to a fear of the unknown as well as a fear related to lack of medical insurance.

Expanded Interview Findings

Results of interviews with migrants were organized according to three major topics: vaccine confidence

narratives, vaccine hesitancy narratives, and barriers to vaccination.

Vaccine confidence narratives

Our interview findings revealed a number of narratives of vaccine confidence among migrant community members (See Table 4.1). The most frequently mentioned confidence theme revolves around *caring for the community*. Interviewees frequently talk about "helping others," "being more considerate of others," and "protecting ourselves as much as the others around us." As interviewee 5 put it, "How many have you helped or how many are you not just thinking? Maybe I can help as I can help others, maybe by vaccinating I can be an example, not only for myself, but for others." The *caring for the community* theme is often presented as a personal choice, such as "one can contain or spread it." One respondent elaborated: "I got my two vaccines… I really think they are helpful … in the aspect of not spreading more."

Table 4.1
Vaccine confidence narratives

Narrative theme	Number of comments
Caring for the community	8
Death narratives/fear	7
Caring for immediate family	5
Living more	5
Vaccine is a benefit	4
Vaccine provides protection	4
No cost or financial incentive	3
Work/school requirement	2
Surviving COVID once	1
Vaccine is safe	1

The second frequently mentioned theme revolves around the *fear of death*. Some comments pertained to seeing family and friends dying from COVID. As migrant 7 phrased it, "I began to meet people very close to me, who got sick, who died from COVID." Other people suggested that the vaccine helps them "not to die." Respondent 4 provided a rich example:

> Because I am an asthmatic person and from what I have seen that many people who have respiratory problems do not survive the virus. If one of them had my vaccinations, I think I might not be here, at best I would continue to be hospitalized.

Notably, the *fear of death* narrative is often accompanied by remorse: "many of those who are no longer here would have wanted the vaccine already" (Interviewee 9).

Caring for the immediate family is also a prominent theme. Many expressed the notion that they didn't want to pass the virus to their loved ones. For example, Interviewee 7 said,

> I am very concerned about making my child sick and more because I had to go out and work and be with other people around me and I did not know if someone else could be sick and I could bring the virus to my home. So I was quite scared and I decided to get the vaccine.

Other respondents were concerned about dying and leaving their family members without support, and the decision to vaccinate was driven by these fears. Interviewee 1 said, "So I felt that as a parent I was not doing the right thing. Because if at that moment something happened to me and to her we have the three children. And what will happen at that time?" Interviewee 9 shared a similar concern: "I do not mind dying, but I do care that my children are left without a mother … that is my most serious decision. In other words, if you understand my concern that something would happen to me and my son needs me."

One identified vaccine confidence narrative is about "*living more*." This theme is best expressed by Interviewee 2: "in the circle of people, relatives or friends that I know that are vaccinated, it just feels like we live more." Another respondent elaborated:

> When they get the vaccine, you will be able to enter wherever you want, but if you do not have the vaccine, you will not go shopping and go to stores or anything. You will not be

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able to participate because you will not have the vaccine and [therefore] I am for taking a vaccine (Interviewee 3).

The *living more* theme is also expressed through reminiscing about the past and the desire to return to pre-COVID times. As one migrant put it, "Well right now, we don't have so many family reunions anymore and stuff. Well, I say they want to get vaccinated, but now they already think more about it [and being] with each other" (Interviewee 3).

The next two confidence themes - *vaccine is a benefit* and *vaccine provides protection* - are closely related. Within the *vaccine-as-benefit* theme, migrants expressed that the vaccine "makes our immune system stronger", makes them "feel more secure," it is "giving you the opportunity to be better in terms of your health," and "it is a product that has a good purpose." An example of the *vaccine-protection* theme is a quote from Interviewee 7: "It's a precaution.... I have noticed that the effects are still a little lower in people who are vaccinated."

Financial incentives were cited at least three times in our interviews. On the question "What do you see as most effective in convincing Hispanics to get the vaccine?" Interviewee 6 responded: "the money thing seems very good to me. Another good example is a migrant sharing their personal vaccination story: "A friend invited me, she told me there will be a free vaccine and she takes advantage of it and you know that we like the good, the free" (Interviewee 3).

The last three identified themes were as follows: *surviving the COVID once, work/school requirement, and vaccine safety.* When the researcher asked one migrant what made them change their mind, he responded: "People who, like me, who get sick with COVID, who contract the virus and feel, that is, what it really feels like is another of the things that makes you change" (Interviewee 4).

Vaccine hesitancy narratives

Table 4.2 summarizes all identified vaccine hesitancy narratives. *Government control* was mentioned most frequently within vaccine hesitancy discussions.

Phrases like "government wanting us to take the vaccine," "government trying to control," "government … they want to kill us," and "the government wanted to put a chip" were abundant. The *government control* category was divided into further sub-categories/myths: a chip myth, controlling the mind, and population control. For example, respondent 4 said, "A strategy to eliminate more human people, because it was overpopulating the world. Things that sometimes I read on social networks." Another example is interviewee 1 who said, "Most of the comments have been that they are going to inject something into you and they're [the government] is going to be able to see and hear what you do." Interviewee 6 elaborated on the chip myth: "there are many inconsistent things that one said that it was the government that wanted, for example, to put a chip." Notably, several migrants questioned the free nature of the vaccine in the context of government action. Interviewee 8 captured this notion best:

> If something is free. You ask why it's free. Are you sure you are injecting us with something correct? … is it because the government wants to inject something bad into us? Or are we an experiment? I do not know why it is free.

Table 4.2
Vaccine hesitancy narratives

Narrative theme	Number of comments
Government control	13
"Created" virus	9
Vaccine side effects	7
Vaccines are not necessary/ COVID not serious	4
Difference in vaccines	2
Fertility issues	2
Virus in the vaccine	1
Rushed vaccine	1
"Hispanics" way of thinking	1

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The "*created virus*" category was also prominent in the interviews. A variety of phrases were used to describe it: "pure invention," "it was all made up," "a hoax or something that's fake," and "experimenting with people." A good example of the "*created virus*" narrative comes from interviewee 4: "I have never gotten sick, and I have not always taken care of this one. My children are fine, I am fine. That does not exist."

Vaccine side effects were also frequently discussed as vaccine hesitancy. The discussed side effects included swelling, dizziness, negative reaction, and fear. Some even suggested that many migrants "felt it really affected their body instead of help[ing] their body" (Interviewee 2). One comment even linked vaccines with death: "some people died for having put it on" (Interviewee 8). Respondent 9 shared their personal experience with vaccinations:

> And the vaccine knocked me down both times with nothing, and I had to lie down. It was horrible, that was horrible. The reactions that I got from the vaccine, I couldn't move, I couldn't stand up, and well, I was scared.

Another respondent shared a *vaccine side effects* story of their friend:

> One friend of his grandfather supposedly said that before he had the vaccine he was a person who could walk on his ranch, working all day. And after the vaccine, he got sick from COVID and has to use a cane to walk (Interviewee 1).

The seriousness of the coronavirus disease and the *necessity of the vaccine* were questioned in the discussions. Taking care of yourself was cited as a feasible alternative to vaccination. For example, interviewee 8 said: "I think that if we take our own care, it would not be so necessary to use it... I also think that it depends a lot on how you take care of yourself, how you eat." Vaccinated people were labeled as not careful: "I do not think it is still necessary ... I think that the people who are using it are because they are hardly careful, they come out a lot."

Other vaccine hesitancy comments, although not frequent, are important for consideration. Two people expressed hesitation due to *differences in vaccines*: "I've had friends that because of the different vaccines they're more skeptical or don't really want to get involved with that" (Interviewee 2). One migrant cited concerns for *fertility issues*: "for no more, for not producing more people, which is supposed to be why they invented this virus, to end people" (Interviewee 9). Interviewee 4 questioned the *rushed nature of vaccines*: "I didn't believe that the vaccine existed, that it was effective or that it was functional, because it was being done so soon and now." Finally, one respondent alluded broadly to the "*Hispanics way of thinking*" as a hesitancy for vaccination: "It is the way of thinking of Hispanics, which is the biggest obstacle that prevents them from seeing beyond reality" (Interviewee 7).

Barriers to vaccination

Language is cited as the primary barrier to vaccinations (See Table 4.3). Migrants shared that language difficulties contributed to delays and inaction. For example, one respondent explained the delay: "sometimes when one does not even know English, it takes time to look for someone to help me translate" (Interviewee 6). Another respondent explained the inaction: "they're not prepared enough for... the language and other stuff. And so I think it kind of just confuses them to the point where they ... just neglect that or put it to the side and don't really want to take action on" (Interviewee 2). The language barrier also contributes to hesitancy associated with government control. As interviewee 2 described, understanding the vaccine as "something that I should get versus something that the government wants me to take."

Table 4.3
Barriers to vaccination

Narrative theme	Number of comments
Language barrier	6
Access to doctors	4
Fear	4

Access to doctors is another barrier to vaccinations. Interviewees pointed out that migrants generally trust what doctors say, but they don't have as much access to doctors to receive the information. Timing is also a factor in their deliberations. One respondent shared that "it takes time to go make an appointment and go sit down and do all the paperwork," and they don't always have the time to follow through. An offered solution is "put[ting] a module outside the Walmart. It is where a lot of Hispanic people go … where people can just go, stop by and put it on" (Interviewee 6).

A more general category of *fear* was set up to capture another barrier to vaccinations. It includes fears of setting up an appointment because many "do not have health insurance plans to back it up for any medical consultation" (Interviewee 4). It also includes a more general "fear of not knowing, of not being certain of things" (Interviewee 5).

CHAPTER 5 | SOCIAL MEDIA FINDINGS

Summary of Social Media Findings

To assess the narratives present on social media, the research team performed both qualitative and quantitative data analyses. Gathering comments from Facebook news sites that were representative of vaccine confidence, the research team identified different narratives, which were subsequently coded by theme. The most common theme was of vaccines providing protection. The associated comments conveyed the message that COVID-19 vaccines do not guarantee that the recipient will not be infected, but still provide protection against severe reactions. Data was also gathered from Facebook group comments. This data revealed no/minimal side effects as the most prevalent theme associated with vaccine confidence.

The quantitative data analysis revealed COVID-19 related Facebook groups among Hispanics have incredibly high volumes of spam. The non-pertinent and unrelated information present on the Facebook group pages was much more prevalent than pertinent COVID-19 related information. The majority of the comments on these Facebook group pages were made by a handful of users who were able to control the narrative of the group. A large portion of these comments reflect highly emotional and religious sentiments. The Facebook groups were also analyzed for sentiment (positive, negative, or neutral). Anti-vaccination groups had overwhelmingly negative comments. More informative groups tended to have more neutral comments

Qualitative Social Media Findings

Facebook news sites

The research team went through 33,417 Facebook news site comments and selected a total of 242 that were representative of vaccine confidence. Each vaccine confidence comment was then evaluated and thematically coded. Themes were not mutually exclusive, and one comment could be classified as belonging to one or more themes. Table 5.1 includes all identified themes and the number of comments.

"*Vaccines provide protection*" was the dominant theme within vaccine confidence comments. The comments were keen on pointing out that COVID-19 vaccines do not guarantee that a person will not get infected. Rather, Facebook users suggest the vaccine "is only a protection and not the cure" (S16), it "helps your system so that when the virus enters your body, it is prepared to fight it" (S133), it "protects you a little so that the virus does not attack you so hard" (S62), and it is "making your immune system stronger" (S75), so that "the body can defend itself better against the virus" (J2), and "we have a little bit of protection against this terrible disease" (S110). *Protection-themed* comments were frequently mentioned in the context of concerns for the family. As one Facebook user said, "I would put it on because the more protection, the more security for my health and my family" (S56),

and another one agreed, "I'm down for the COVID-19 vaccine to protect myself and all others around me" (S92). Perhaps the following comment captures these two themes best: "Vaccines prevent severe disease… You have to get vaccinated to avoid falling into these hard and painful situations for families who are or have experienced the loss of a family in this pandemic" (S112).

Table 5.1
Vaccine confidence narratives in Facebook news sites comments

Narrative theme	Number of comments
Vaccines provide protection /not being at risk	45
Vaccine is safe and effective	29
Preventing death	27
Minimal/no side effects	25
Concern for the family	23
Unvaccinated are a danger/fear of unvaccinated	16
COVID vaccine is like other vaccines/historical comparisons	12
Responsibility narrative	11
Risk/benefits analysis	11
Believe in science	10
Concerns for the community	9
Overcrowded hospitals/protecting medical workers	9
War on COVID/End of pandemic	8
Double standards for anti-vaxxers	4
Vaccine saves lives/is miracle	4
Return to normal	3
Minorities disproportionately affected	3

The second most popular theme within comments is that *"vaccines are safe and effective."* Many comments within this category are very expressive (using exclamation marks and emojis). Two examples emerge: "without the vaccine, millions would have died. This is the miracle of the vaccine. Saving lives!" (S30) and "In the name of God keep coming for everyone to be vaccinated say it's the best vaccine out there" (J6). Some comments within this group address the myth about the experimental nature of COVID-19 vaccines:

> When a vaccine is approved even for emergency use only, there's data to demonstrate their efficacy and most importantly safety first and [it is] carefully monitored. Let's stop the fearmongering, an approved vaccine for public use is a proven vaccine not an "experimental" vaccine (S98).

Often, Facebook users comment on articles that address vaccine effectiveness and side effects. One user, for example, said "They are specific cases where the patient is under a regimen of medication that suppresses the immune system. The vaccine works except in cases like these" (S13). Another one gave an example of an exception: "Vaccines work and save lives, they don't generate antibodies in people who take immunosuppressive drugs" (S14).

A personal story of vaccine side effects was also shared to illustrate that vaccines are generally safe and effective:

> They gave me the vaccine against hepatitis years ago, and I got that syndrome, I was vaccinated at school, and it was only me who got the syndrome, I think it's a matter of luck 😊. But I [didn't] stop vaccinating in the later years. In pregnancies, I vaccinated against other diseases and everything [was] ok 👍. Do not stop vaccination against COVID, you do not know how effective. It is so you do not get to a hospital or need an ICU bed (S26).

Preventing death and *minimizing side effects* were the next two categories. Within the *preventing death* category, lots of comments mention intensive care units (ICUs) and vaccination as a means of avoiding them: "many say nonsense about the vaccine and many families are losing family members in ICUs" (S28) and "I'd rather get vaccinated and play with it than end up in

the ICU" (S29). Many comments are very emotionally charged: "I have buried too many COVID-19 victims… I have never rejected vaccines and will not start now" (S89) and point to the Hispanic population to be greater affected by the virus: "In Texas, if Hispanics don't want to be vaccinated, they will be the most dead and sickest ones… it's not the same to be vaccinate than not to be" (S106).

Preventing death comments were often linked with a discussion of *side effects*. The following three comments illustrate this point well: (1) "I have not known of anyone who died by the vaccine. On the contrary I know people who died of coronavirus without vaccination" (S116), (2) "I very much agree that it is better to have the symptoms of the vaccine for a few days than to get the virus. Virus can cause death, while [the] vaccine protects us and our family" (M17), and (3) "The side effects, if any appear, can be treated with medication and are not fatal. You will not die from the vaccine but you can die from COVID-19" (M19).

The next category, *concern for the family*, revealed some interesting findings. "Fear," "loss," and "scare" were prevalent words within this group of comments, and this comment epitomizes this theme: "Good morning, everyone should get vaccinated because my daughter is in school and I have my 75-year-old mother, and I'm scared" (S48). Several comments brought up financial concerns: "I hope all those who do not get vaccinated have insured [themselves] of higher medical expenses because there is no money that can reach them if they get sick. Think of their family if they pass away [and] the debt is left to … their children" (S2). Others focus on the unvaccinated who surrounded their families: "I got vaccinated because I saw how my son suffered when he got coronavirus and I'm already afraid of sending my child to school if the teachers don't get vaccinated" (S42). Several people also shared how their opinions on vaccinations changed due to their family: "I was afraid of the vaccine like several people, but seeing family and friends, even after COVID left them health consequences.. [it is] almost time for my 3 vaccine, and the metal does not stick, and I still do not become a zombie" (M53).

Sixteen pro-vaccine comments were labeled as "*danger/fear of unvaccinated*." Here, people shared how unvaccinated people pose a danger to their communities and society at large, and shared their fear of the unvaccinated. These comments were often presented in conversions about personal freedoms. For example, one person wrote, "We all have freedom but in my case, I prefer not to meet with the non-vaccinated (S31). Another one added, "Freedom ends where the right of others begins. So the unvaccinated are blocking freedom to others because they are a potential danger" (S35). Another comment reads, "Very good, he can exercise his autonomy but not putting others at risk" (S36).

A dozen comments in our study *compared COVID vaccine to other existing vaccines*, reminding the readers that "all vaccines are good" (J3). Comparisons were drawn to flu, hepatitis, smallpox, polio, rubella, mumps, measles, and tetanus. These comparisons included a variety of circumstances: mandatory vaccinations in grade schools, for soldiers, and for university students.

One person shared their personal story with hepatitis vaccine side effects early in life and their persistent decision to get vaccinated later in life:

> They gave me the vaccine against hepatitis years ago, and I got that syndrome …I think it's a matter of luck 😊 . I did not stop vaccinating in the later years. In pregnancies, I vaccinated against other diseases, and everything ok 👍. Do not stop vaccination against COVID, you do not know how effective it is so you do not get to a hospital or need an ICU bed (S26).

The *responsibility theme* appeared in a dozen comments. "It's our responsibility as adults to protect our children because now there is no other choice" read one comment (S9). "For the irresponsibility of others we all have to pay the consequences, I already got vaccinated and you? 😂😂😂😂" read another (S135). Perhaps, the last comment in this group captures this sentiment well: "Well I'm doing my part by getting my vaccines and I'm down for the COVID19 vaccine to protect myself and all others around me" (S91).

The *risk/benefit analysis* is an interesting group of comments that acknowledged there are risks to any vaccinations, but the risks outweigh the benefits, and "we have less to lose if we vaccinate" (S31). For example, one person wrote: "[with] any vaccine or any medicine there is always risk, but COVID has been more deadly than the same vaccine" (S10). Another person shared the alternative to not vaccinating, "I'd rather get vaccinated and play with it than end up in the ICU 🧑🏻‍⚕️🟫" (S29).

The *"belief in science"* category included ten comments. Facebook users expressed their trust in the scientific community. For example, one person wrote: "The positive thing about this is that again science will help us get out as it always has" (M35). Another person added: "We should consult with our family doctors and science rather than ignorant mythomaniacs" (M40). Scientific journals like The Lancet were mentioned, and one user closed with a rhetorical question: "Who do we believe: the bureaucrats or the scientists?" (J7). And another Facebook user seemingly responded: "Science always wins" (M49).

The last seven identified categories included less than ten comments, and this report presents the most representative quotes for each of these categories. The *concern for the community* theme is best captured in this quote: "Unfortunately, Latinos distrust the healthcare system… It's more important for us as a community to step up and take the vaccine because we are the community most impacted by this virus" (S90). The next theme, *overcrowded and overwhelmed medical community*, includes concerns for both facilities, "don't take up a hospital bed and put more people at risk. Stay at home" (S81), and medical personnel "please think about what doctors are human beings and that for their irresponsibility they are on the front line, risking their lives to save theirs, they also have family" (J2). The *war on COVID/end of pandemic* theme included comments like "the most important thing is to hurry up and end this problem" (M23) and "encourage everyone [to get vaccinated] so that this ends" (M37). A few comments pointed to *double standards for anti-vaxxers*, and this post captures this comment theme well: "Many people with 'panic' about vaccines [are] smoking cigarettes with

hundreds of toxic substances, drinking industrial products with many preservatives, with a very high percentage of cancer production of all types" (S27). A small number of comments in our sample belonged to the *"vaccines save lives/are miracles"* category, and the following comment captures it well (emphasis in original): "Get the vaccine you want, and do not worry about others … THE Vaccine IS ALREADY THE MIRACLE REMEDY" (M29). The *"return to normal"* theme included comments like "I pray to God that all this ends soon and everything returns to normal!" (S80). The last identified theme is *"disproportionate effects on minorities,"* and several comments point to this theme: "anti-vaccines account for 97% of hospitalizations, and more among Hispanics and black" (S113).

Facebook groups

Similar to the procedure with Facebook news sites, the research team selected vaccine confidence comments from Facebook groups that addressed COVID-19. Out of 1388 Facebook group comments, a total of 130 vaccine confidence comments were selected for review. Each comment was evaluated and thematically coded. Themes were not mutually exclusive, and one comment could be classified as belonging to one or more themes. Table 5.2 includes all identified themes and the number of comments.

Vaccine side effects was the most frequent theme that appeared within vaccine confidence comments. Here, Facebook users were discussing minimal to no side effects after their vaccinations, such as sleepiness (FJ25), mild headache (FJ33), fatigue (FJ25), body pain (FJ32) temperature (FJ46), discomfort (FJ71), and little pain in arm (FJ42). Some people were commenting on the duration of side effects, "the effects only lasted a day" (FJ13), while others on the intensity compared to symptoms of the disease. It is clear that the users often insisted that side effects are minimal compared to the disease symptoms, "the effects are very mild. In some people they are stronger but they will never be more serious than being with the virus and intubated" (FJ30) and "It's important to get vaccinated. It's better than being

intubated" (FJ43). Some even shared their own story in the groups:

> I was very seriously [ill] from COVID, hospitalized for 2 months last year. I took the 2 doses of Sinovac. With the second I felt a little unwell for a few days but, nothing to worry about. I think after being so ill, I prefer to be more cautious. That's why you need to get vaccinated (FJ72).

Table 5.2
Vaccine confidence narratives in Facebook group comments

Narrative theme	Number of comments
No/minimal side effects	47
Vaccines provide protection	15
Death narrative	14
Vaccination access	13
Concern for family	13
Vaccines are safe and effective	9
Risk/benefit analysis	7
Recommended by health professionals	7
Dangerous virus	3
Trust in vaccine	3
Belonging to at-risk category	2
Vaccines save lives	2
War on COVID	2
Caring for others/community	2
No active virus in vaccine	2
Return to normal life	2
Belief in science	2

Clearly, the *side effect* discussions were often associated with the *risk/benefit narratives* (a total of seven comments). For example, one comment read, "Put them on, it's better to be vaccinated, and remember that thrombosis was only 5 cases, and of the five only

one died" (FJ55), and another one added "we have nothing to lose but to gain" (FJ56). Perhaps, the following comment captures this notion best: "you just have to weigh the pros and cons of vaccination, but with well-founded arguments, and with rationality) (FJ64). One group member shared their personal story: "I have high blood pressure and went through severe COVID last year, I got vaccinated anyway. I consider the risks of the vaccine to be low compared to another COVID infection" (FJ65).

"*Vaccines provide protection*" was another dominant theme. Facebook group members sounded hopeful about vaccines' ability to protect against the disease: "Let's hope vaccines will protect us all" (FJ11). Some were knowledgeable about how vaccines work: "The vaccine is aimed at creating a defense against a new infection, that's all" (FJ36), "Any percentage of effectiveness in a vaccine is better than having 0% protection" (FJ57), and "no vaccine has the virus, it's only a protein to protect the body" (FJ54). On the other hand, others admitted that they were unaware of how vaccines actually work: "I don' t know anything, but hopefully it helps us with the consequences" (FJ28). One personal story very clearly illustrates the desire to be protected:

> I also got sick from COVID, not serious for hospital, but I had to use oxygen at home. My whole family sick at the same time, my parents lowered their oxygenation, they also needed oxygen. I was so scared they would get worse and lose them … But thank God we pulled through. I got a very major depression. But with all that, I don't hesitate to get the vaccine, I look forward to it, at least to be a little more protected, I panic more about reinfection (FJ63).

The *"death narrative"* was very prominent within the comments. Most Facebook users were posting about their mothers, fathers, spouses, and loved ones dying from COVID complications. Many were adding that "vaccines arrived late" (FJ32) to their communities, and their loved ones could not be saved. As one Facebook user put it, "there are thousands of dead whose families would give anything to have reached the time of the vaccines" (FJ48). Others were afraid to die from COVID. For instance, one person said,

"Believe me, I prefer a thousand times the side effects than being in a bed connected to oxygen, not being able to see the family and die alone" (FS37). Another person shared, "I prefer to put it on and not go to a hospital and never come out alive" (FS41). The death narrative comments are very full of emotions, as one would assume: "My dad went to the hospital on Nov 3rd. It was the last time I could touch him and say I love you dad…" (FS37). Another Facebook user shared:

> Today we are going to the lake and botanical gardens to start releasing her ashes (in an ecological way) as part of the process of letting go and remembering with immense love...and balance, as she would have liked it. Take a deep breath and get ahead with the vaccine (FJ58).

A dozen comments in our sample discuss *access to vaccination*. In these comments, group members share their experiences with vaccination sites, residency requirements, availability of different brands of vaccines, required identification documentation, parental consent forms, appointments, and information asked. The following comment is illustrative of the questions that people ask: "Hello, I am Mexican and currently live in Mexico, I have no residence or anything similar, but I wish to go get vaccinated next month. My question is, do I need to prove that I am a resident to get vaccinated in Florida?" (FS15).

"Concern for family" was another prominent category. Many group members urged others to protect their families by getting vaccinated: "I address all the people who are still unvaccinated. Keep protecting ourselves [and] take care of our family" (FJ3) and brought up the consequences of not getting vaccinated: "remember that there are thousands of dead whose families would give anything to have reached the time of the vaccines" (FJ48). A number of heart-breaking personal stories appear in these comments: "If only the vaccine had arrived a month earlier, my mother (whom we over-care for her age) might still be on this earthly plane. A tremendous loss" (FJ21) and "my dad went to the hospital on nov 3rd. It was the last time I could touch him and say I love you dad" (FS37). Another personal story

emphasized the stress that is put on a family when somebody has a severe COVID case: "I have it clear. it's the best thing I did get vaccinated. I spent it in September very serious 73 days intubated, four months in hospital. Today I am fine, but it was very painful for my family…" (FJ69).

Nine comments capitalized on the *safe and effective* theme. Here, one Facebook user argued that "any percentage of effectiveness in a vaccine is better than having 0% protection" (FJ57). Another one wrote, "We have access to safe and effective vaccines that are being provided to save lives, which should ALWAYS be the first priority" (FJ73). Other comments directed people to sources of information regarding vaccine effectiveness. For instance, one comment suggested to "look on the page of the Secretary of Health [when it] comes to the effectiveness of AstraZeneca vaccine" (FJ53). Within this category, a number of comments talked about Sputnik vaccine: "Sputnik vaccine, so far considered the best vaccine in effectiveness and is not causing serious adverse side effects. It is the most reliable as Russia had been creating vaccines for different coronavirus for more than 10 years" (FJ50).

Several comments suggested that COVID vaccines are *recommended by health professionals.* Facebook users sited doctors, virologists, general practitioners, and the Secretary of Health. Health professionals recommended vaccination because it is effective (FJ53), because it prevent recontagion (FJ52), and because people "have nothing to lose but to gain" (FJ56).

The last nine identified themes included less than five comments each, and this report presents the most representative quotes for each of these categories. The *dangerous virus* category is best described through the following comment: "This virus is very strong, and we must not let our guard down" (FJ5). The *trust in vaccine* theme is best captured in this quote (emphasis in original): "WE TRUST IN GOD AND IN THE Vaccine. Friend I hope you continue to feel good" (FJ23). The *war on COVID* theme included comments like "Let's hope vaccines will protect us all, and help end this terrible virus as soon as possible" (FJ11) and "work collectively to eradicate it" (FJ76).

A few comments pointed to *at-risk status* as the reasoning for vaccine confidence, and this post captures this theme well: "I got COVID and I got many consequences among them rheumatoid arthritis, so I am very afraid" (FJ24). A small number of comments in our sample belonged to the "*vaccines save lives*" category, and the following comment captures it well (emphasis in original): "vaccines … save lives, which should ALWAYS be the first priority" (FJ73). The theme "*caring for others*" included two vaccine confidence comments, and one of them read: "I have realized that there are many good people in the world who do care about the well-being of others" (FJ18). The "*return to normal*" theme included comments like "Think about the possibilities of being able to make a 'more normal' life, with obvious precautions" (FJ57). The last identified theme is *belief in science*, and one comment captures it well: "Read scientific reports on vaccines and how they are made" (FS8).

Quantitative Social Media Findings

Summary

Overall, the quantitative data shows that COVID-19 related Facebook group pages among Hispanics feature relatively low engagement, with an incredibly high volume of spam and unrelated posts (i.e., soliciting services, marketing products, making personal announcements/statements unrelated to COVID-19 or COVID-19 vaccination). Group page posts and comments are characterized by a roughly 10 to 1 non-pertinent to pertinent information ratio concerning COVID-19. Engagement to posts was also surprisingly low (m= 0 to 5.1 reactions), and the top 10 users on a given group page drive anywhere between 27% to 87% of the conversation. Sentiment within the group pages mostly decreased through the sampled timeframe; with anti-vaccination groups producing mostly negative sentiments, and information focused groups largely producing neutral sentiment. Joy was the most prominent emotion expressed through the posted content, while more negative emotions and hate speech were less prominent. Cluster analyses show a high degree of religious associated words, as well as a concern for cost.

Descriptives

The adapted script extracted the following from the purposefully selected Facebook group pages (See Table 5.3). Despite the purposeful sampling of group pages, the overall engagement in some groups was relatively low, only yielding a handful of posts after screening for spam. The groups with the highest engagement tended to be those focused outside of the United States; "Vacuna COVID-19 Guatemala" and "Informacion del COVID-19" represented Guatemala and Mexico respectively. A further cleaning process for quality was conducted manually to remove posts and comments that were irrelevant or did not provide material engagement.

Exploratory data analysis

An analysis of the number of comments per post shows most posts have between 4 to 9.7 comments. There is one outlier with 123 comments. This can be seen in the distribution of the comments in Figure 5.1.
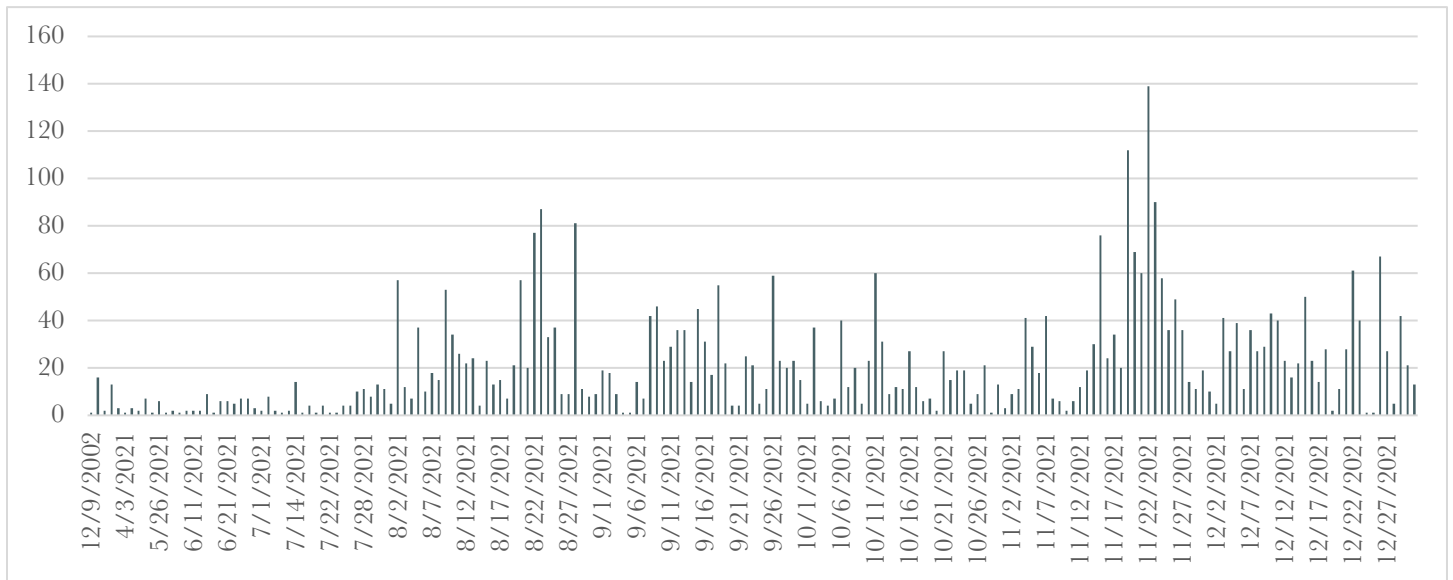
Figure 5.1. Comment distribution

Figure 5.2. Timeline of comments

From a temporal perspective the comments have two peaks; one concentrated around August and the other in November (See Figure 5.2).

There are leaders in each group who produce a disproportionate amount of the comments. The smaller the group, the more the top 10 users control the narrative. Table 5.4 presents each group, the number of users who commented, and the percentage of comments by the top 10 users.

Another measure of the level of engagement are reactions to posts by users. From the distribution of reactions, we can see that most posts had between 0 to 5.1 reactions. Again, indicating the low level of engagement from these communities overall. While some posts drove reactions over 30, these represented a very small percentage of the total dataset (See Figure 5.3).

Table 5.4
Facebook groups, number of commenting users, and the percentage of comments by the top 10 users

Group	Users	Top 10 %
Vacuna_COVID-19_Guatemala	463	30.66%
Informacion_del_COVID-19	397	22.48%
Embarazadas_con_y_sin_COVID-19	153	29.16%
Información_sobre_Vacunas_contra_el_COVID_en_la_Florida	181	35.43%
VACUNA_COVID-19	132	27.53%
Sobrevivientes_de_COVID19	97	40.09%
Anti_vacunas_!!	46	60.13%
Reacción_de_la_vacuna_Pfizer_Gto_Capital	19	87.14%
No_a_la_Vacuna	29	71.21%
Yo no me vacuno y voy sin mascarilla!!!	17	73.08%

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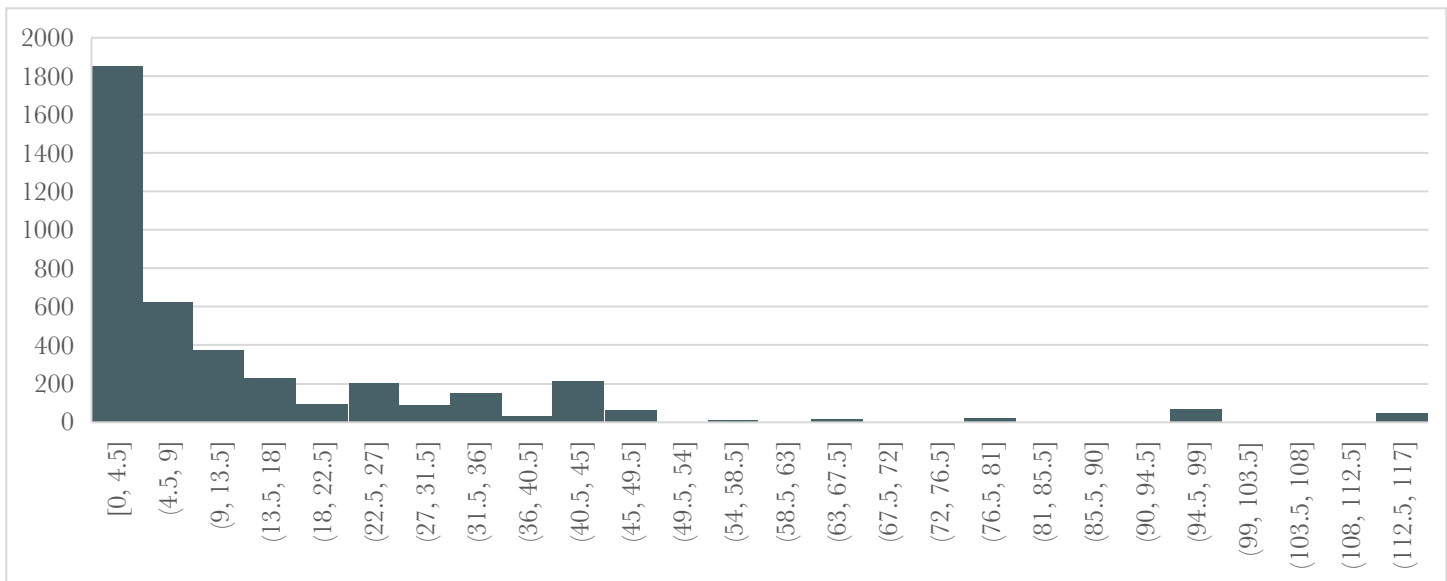
Figure 5.3. Post reactions

K-means modeling

A general method for analyzing a dataset is with the use of a K-means[1] modeling. K-means falls under the category of unsupervised machine learning algorithms. K-means attempts to look at a dataset and break it down into groups of "clusters." The algorithm can often see patterns in the data that would otherwise elude researchers.

The first step in using a K-means algorithm is defining the number of clusters or the "k." The number of k's tells the algorithm where to start the center of the clusters or "centroids." These are often imaginary locations that the algorithm randomly picks. Defining the k is important because once you input the value, the algorithm will then measure the distance of each point in the data to the centroid. By default, K-means uses the Euclidean Distance[2] to measure the distance between the centroid and a point. The Euclidean Distance or the length of a line segment between two points, is a method for measuring which data points are closest to which centroid. The formula for calculating this distance is:

$$d(\mathbf{p}, \mathbf{q}) = \sqrt{\sum_{i=1}^{n}(q_i - p_i)^2}$$

Too many k-values and the model will overfit the data and provide noise. Too few k-values and the algorithm will have a high level of error or "overlap." To determine the appropriate k-value we use the Elbow Plot method.

The Elbow Plot method of selecting the optimum k-value plots the sum of the squared distance (the error) between each point and the centroid of the cluster. These are sometimes called distortions. The theory behind the plot is that as the number of k-values increases, the error rate will decline sharply until each additional value of k does not provide much further reduction in error. This is called the elbow of the plot.

Since K-means elevates data to a geometric plain, it becomes essential to convert text data or "strings", to numeric values. This is accomplished by a process called Vectorization.[3] Vectorization as it relates to Natural Language Processing (NLP), is the process of mapping words to a vector of real numbers. These

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[1]https://www.sciencedirect.com/science/article/abs/pii/S0031320302000602

[2] https://en.wikipedia.org/wiki/Euclidean_distance_matrix

[3] https://en.wikipedia.org/wiki/Vectorization_(mathematics)

numbers can then be used to feed to the algorithms to make its clustering predictions.

For the comment data, we first import the data as a CSV file using the Pandas[4] read_csv function. Because the text is in Spanish and includes emojis, we encode the data in latin-1 versus UTF-8 encoding. To properly cluster the words in the data, we remove the generic words from the text. These include words such as "a", "the", "and", etc. as these words are ubiquitous in text strings and provide no useful information for the algorithm. These words are referred to as stop words (See Figure 5.4). Since the text is in Spanish we can use the Spanish stop words list provided in the stop_words[5] library. We also want to bolster the stop words with other words that provide no meaningful value. We determine those words by running the algorithm iteratively. In the case of this dataset, we have had several names and meaningless phrases added to the list.

These words are removed from the text. We then use the TfidfVectorizer in the Sklearn[6] library of Python

to vectorize the dataset. The function gives a numerical value for each word in each comment. A sample of the code and results are presented in Figure 5.5.

The words are now numeric values that can be fed into the K-means model. Next, we determine what value of "k" is optimal. To do this, we run a range of possible k-values through the K-means model in the Sklearn library. At each value of "k" from 1 to 20, we will calculate the k-value. We will then use matplotlib[7] library to plot the results. This gives us our elbow plot to analyze (See Figure 5.6).

Based on the plot, we see the optimal k value at 5, which represents the point at which the slope of the line begins to flatten out. Although the plot is not a clear elbow, we can still make an inference based on the first major change in slope. This allows us to use our values of k and develop clusters. Figure 5.7 presents a list of top 10 words in each cluster.

```
stopwords = get_stop_words('spanish')
newstopwords = ('si','muchas','gracias','https','xx','scontent','facebook','pablo','bravo','lisa','geduldig')
for i in newstopwords:
    stopwords.append(i)
print(stopwords)
```

Figure 5.4. Procedure of removing stop words

```
vectorizer = TfidfVectorizer(stop_words=stopwords)
X = vectorizer.fit_transform(documents)
print(X)
  (0, 5134)      1.0
  (1, 230)       0.36685654876116314
  (1, 1470)      0.3281427140506947
  (1, 8367)      0.3281427140506947
  (1, 6698)      0.34351644643243645
  (1, 7448)      0.3074910894409293
  (1, 1706)      0.29985823144550333
  (1, 2724)      0.36685654876116314
  (1, 3427)      0.3537120847860344
  (1, 1071)      0.2964721686229487
  (2, 3399)      0.32090150607779394
```

Figure 5.5. TfidfVectorizer code

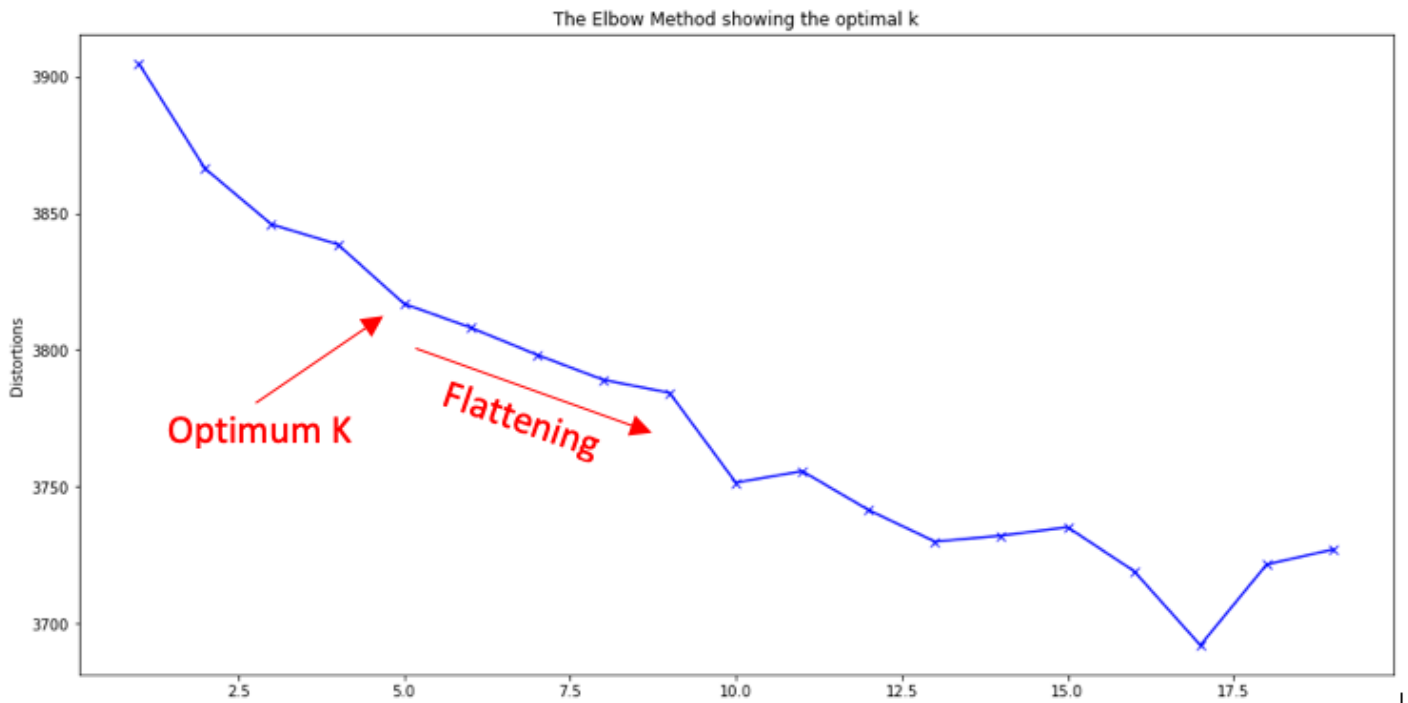*Figure 5.6. The elbow method showing the optimal k.*

```
Cluster 0:          Cluster 2:
 dani                dosis
 rebelamos           información
 simple              solo
 viene               vacuna
 we                  dios
 healthimpactnews    covid
 through             bien
 living              días
 are                 pfizer
 vacuna              puede
Cluster 1:          Cluster 3:
 video               mil
 útiles              eugenia
 dimero              gamarro
 diosbte             pineda
 dios                rhociioo
 dio                 angelica
 dinero              hernandez
 dineral             dineral
 dimos               diosito
 dimas               diosbte
Cluster 4:
 4731212966934866
 vo6ef9pmxuonfimjh_gavh7nr
 xdv8pef8f0vmgbch0ln5aaj4qqhcju24n4v4mnb
 azvbtd3uk
 kis6tee
 tzvwijllktosefvgyx5n8e8evquavxswzvmbx
 zognb2vt_pgfq8x4ylxif5cv8
 __cft__
 type
 photo
```

Figure 5.7. Clusters

From the clusters we see a pattern emerges in terms of the narratives that guide the comments. We can extract the top ten words that the algorithm selected as important. Cluster 1, and to some degree Cluster 3, show a heavy concentration of religious text as well as emotion words such as "dineral" which means "a lot of money" [similar to the English phrase, "a ton of money"]. Cluster 2 is more informative regarding the vaccine; with words such as doses, vaccines, COVID, and Pfizer form part of the top words in this group. Finally, the algorithm accurately extracted any URLs and isolated them to their own group in Cluster 4.

Sentiment analysis

Another machine learning method to analyze group comments is to study the sentiment of each comment. This is performed by using sentiment analysis in Python. Sentiment analysis uses a machine learning technique called Natural Language Processing (NLP). The way sentiment is derived is by scoring each word on its level of positivity, negativity, or neutrality. A positive word is valued at 1, negative at -1, and neutral at 0. A string of text can then be

scored based on its composition of words. The scoring comes from a pre-built lexicon of words that are used to compare the composition of words in a text string to the lexicon. The algorithm can then derive a score and select whether the sentiment of the text is positive, negative, or neutral.

We required a lexicon that could interpret Spanish, as well as one that accounted for slang, emojis, and shorthand commonly used in social media. The PySentimiento[8] library has this type of lexicon and provides a sentiment analysis to score our comments. Similar to the K-means algorithm, we import our comments as text, then build an analyzer (or lexicon) by assigning it the task of sentiment and language Spanish.

```
analyzer = create_analyzer(task="sentiment", lang="es")
```

We then iterate through the comments by creating a loop using the analyzer. Finally, the analyzer provides us with a list of predictions on the sentiment of each comment. Figure 5.8 presents the results. With these, we then assign the results back to our comments to see the ratio of each sentiment level by group (See Table 5.5). Anti-vaccination groups overwhelmingly have negative comments. Whereas more informative groups tend to have more neutral commentary.

We also examine the sentiment change over time. Figure 5.9 shows how the daily sentiment score changes from August to December among the groups.

Table 5.5
Sentiment level by each Facebook group

Group	POS	NEG	NEU
Vacuna_COVID-19_Guatemala	167	78	1016
Informacion_del_COVID-19	133	232	636
Embarazadas_con_y_sin_COVID-19	114	101	344
Información_sobre_Vacunas_contra_el_COVID_en_la_Florida	54	76	316
VACUNA_COVID-19	10	48	189
Sobrevivientes_de_COVID19	26	79	117
Anti_vacunas_!!	5	82	71
Reacción_de_la_vacuna_Pfizer_Gto_Capital	4	40	26
No_a_la_Vacuna	3	19	44
Yo no me vacuno y voy sin mascarilla!!!	0	10	16

To examine sentiment more clearly, we create an index by setting July 31st to 100 and letting the sentiment flow forward. Figure 5.10 presents the overall sentiment in a declining trend. There was a positive boost in November, however it is possible news about the Omicron variant in December brought the score back down.
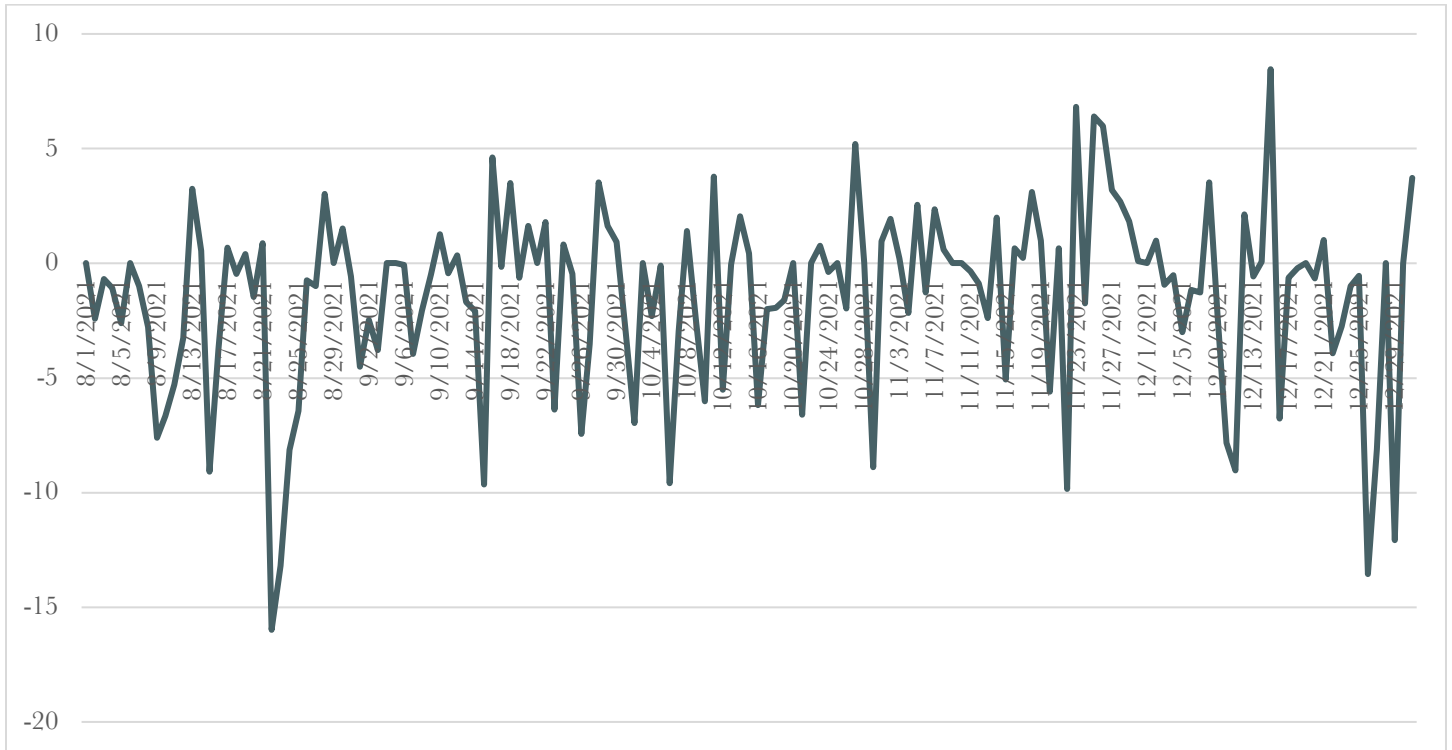

[AnalyzerOutput(output=NEU, probas={NEU: 0.973, NEG: 0.016, POS: 0.011}), AnalyzerOutput(output=POS, probas={POS: 0.950, NEU: 0.048, NEG: 0.001}), AnalyzerOutput(output=NEU, probas={NEU: 0.978, NEG: 0.016, POS: 0.006}), AnalyzerOutput(output=NEU, probas={NEU: 0.676, POS: 0.255, NEG: 0.069}), AnalyzerOutput(output=POS, probas={POS: 0.937, NEU: 0.062, NEG: 0.001}), AnalyzerOutput(output=NEG, probas={NEG: 0.905, NEU: 0.091, POS: 0.004}), AnalyzerOutput(output=NEG, probas={NEG: 0.877, NEU: 0.122, POS: 0.002}), AnalyzerOutput(output=NEU, probas={NEU: 0.963, NEG: 0.032, POS: 0.006}), AnalyzerOutput(output=NEU, probas={NEU: 0.901, NEG: 0.095, POS: 0.004}), AnalyzerOutput(output=NEU, probas={NEU: 0.959, POS: 0.031, NEG: 0.010}), AnalyzerOutput(output=NEU, probas={NEU: 0.991, POS: 0.004, NEG: 0.004}), AnalyzerOutput(output=POS, probas={POS: 0.671, NEU: 0.325, NEG: 0.004}), AnalyzerOutput(output=NEU, probas={NEU: 0.841, NEG: 0.147, POS: 0.012}), AnalyzerOutput(output=NEU, probas={NEU: 0.946, NEG: 0.052, POS: 0.002}), AnalyzerOutput(output=NEU, probas={NEU: 0.889, NEG: 0.109, POS: 0.002}), AnalyzerOutput(output=NEU, probas={NEU: 0.978, NEG: 0.017, POS: 0.005}), AnalyzerOutput(output=NEG, probas={NEG: 0.979, NEU: 0.020, POS: 0.001}), AnalyzerOutput(output=NEG, probas={NEG: 0.985, NEU: 0.014, POS: 0.001}), AnalyzerOut

Figure 5.8. Sentiment analysis.

Figure 5.9. Daily sentiment score changes over time
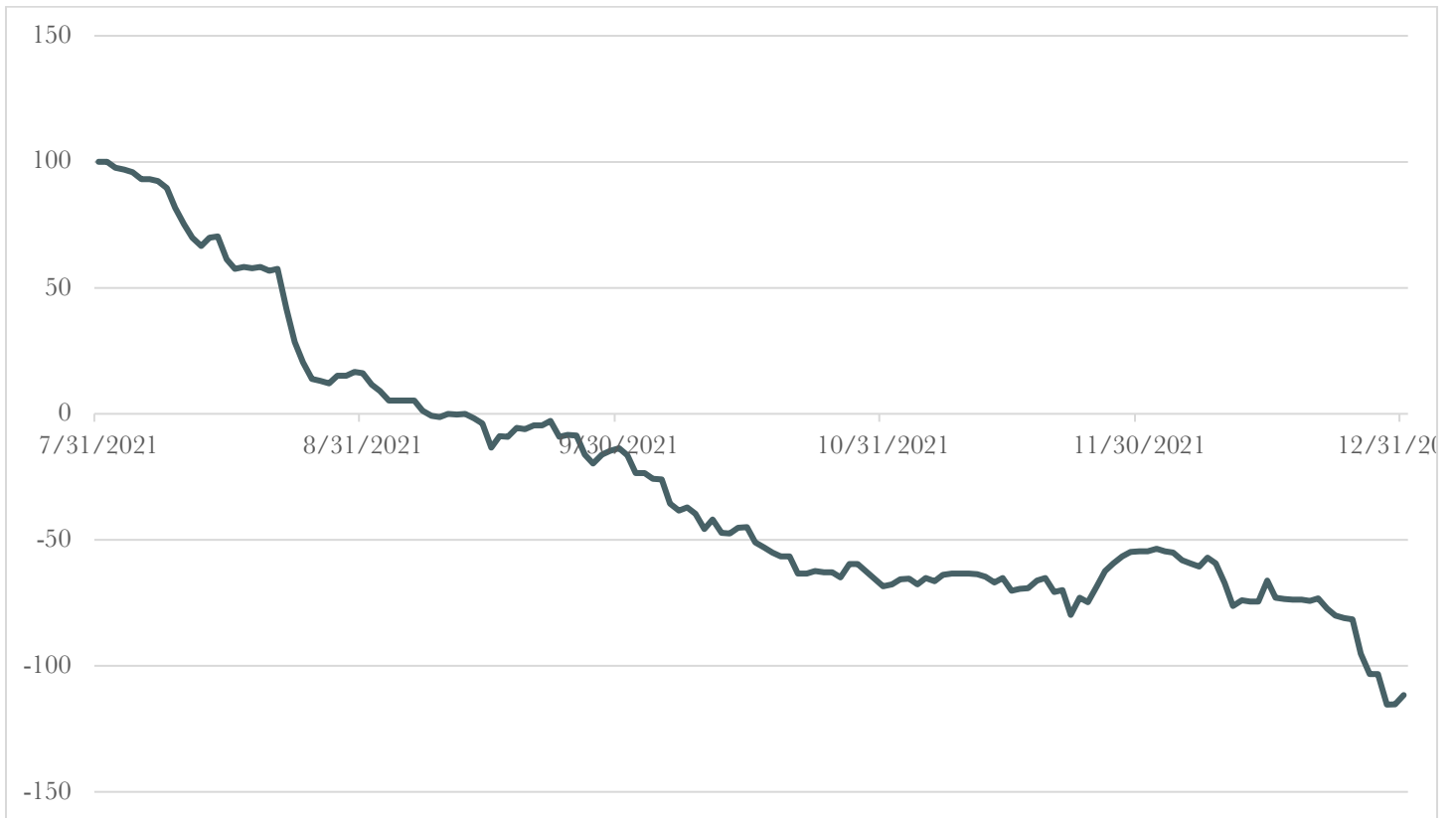
Figure 5.10. Sentiment index over time

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Table 5.6
Emotional qualities of Facebook comments

Group	Anger	Disgust	Joy	Sadness	Surprise
Vacuna_COVID-19_Guatemala	3	2	2		
Informacion_del_COVID-19	1		56		1
Embarazadas_con_y_sin_COVID-19		2	73	1	1
Información_sobre_Vacunas_contra_el_COVID_en_la_Florida		1	52		2
VACUNA_COVID-19			2		
Sobrevivientes_de_COVID19			2	1	
Anti_vacunas_!!	1	1	8		
Reacción_de_la_vacuna_Pfizer_Gto_Capital		2	9		
No_a_la_Vacuna			158		
Yo no me vacuno y voy sin mascarilla!!!	1				

The algorithm also lets us examine the emotional quality of comments based on the content (See Table 5.6. This gives us the prevailing emotions across the posts and comments. Joy was the most resonant emotion within the posts and comments.

Finally, we use the algorithm to judge the level of hate speech. The algorithm looks at the content and provides a score of how hateful, targeted, or aggressive each comment is. The score is from 0 to 1. By mapping these scores overtime, we get a view of the hate speech in the comments (See Figure 5.11). Across the data, instances of hate speech were relatively low; never averaging higher than 0.3 through the period with the exception of one day.
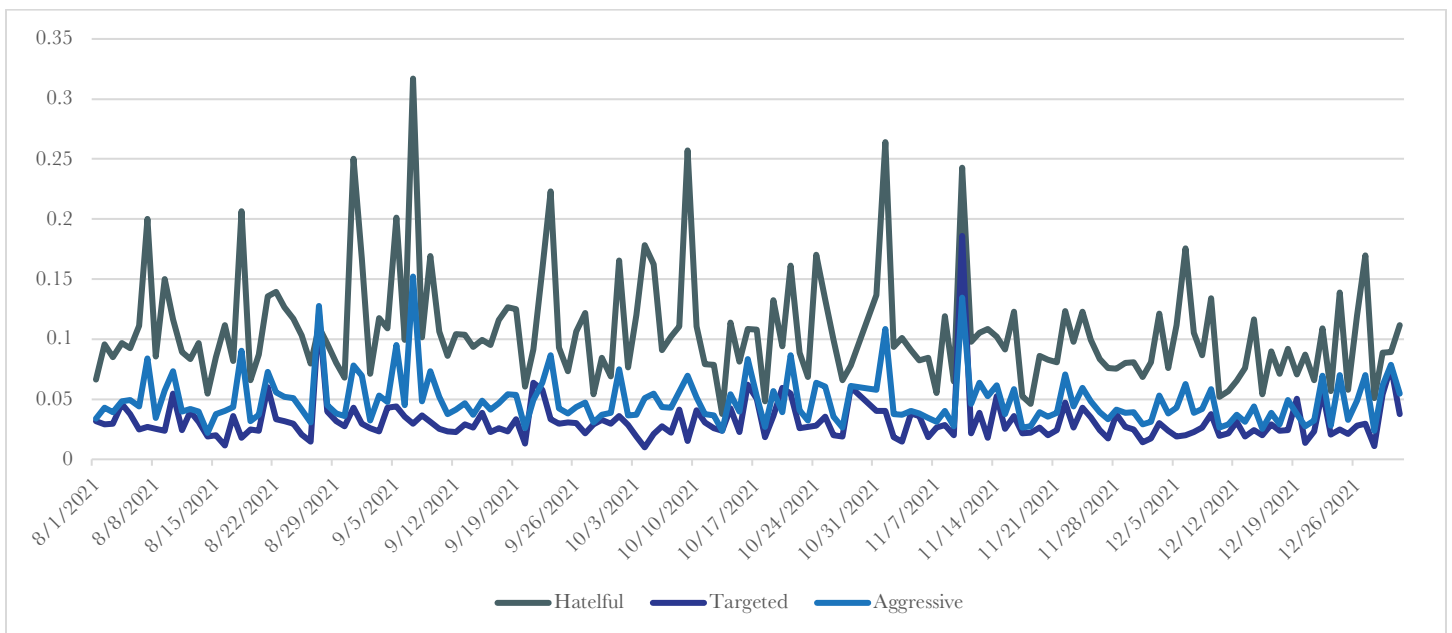
Figure 5.11. Hate speech over time

CHAPTER 6 | EXPERIMENTAL SURVEY FINDINGS

Summary of Experimental Survey Findings

The survey was constructed specifically to validate the persuasive impact of culturally tailored images, thematic message elements, and narratives among Hispanics concerning COVID-19 vaccine confidence and vaccine uptake. **The results statistically demonstrate that culturally specific narratives significantly improve vaccine confidence among Hispanics; particularly those who see themselves at risk for serious illness from COVID-19.** Further, the findings show that culturally specific images and use of the Spanish language enhance message preference, while amplifying adapted culturally specific persuasive elements from Hispanic social media posts largely outperform or have equal impact to generic health service messages concerning COVID-19.

Expanded Experimental Survey Findings

The expanded survey findings are presented in three subcategories of inquiry concerning Hispanics:

(1) Language and image preferences for COVID-19 vaccination on social media,
(2) Persuasive messaging preference for COVID-19 vaccination,
(3) Narrative element preferences.

Table 6.1 includes the hypotheses and research questions that guided the experimental survey.

Data collection

We recruited two samples: one consisting of Hispanics, the other of non-Hispanic in the US via MTurk. Given the hypotheses 1 to 4 aim at comparing ingroup favoritism and outgroup derogation between Hispanics vs. non-Hispanics, we collected one dataset only using a Hispanic sample and the second dataset from non-Hispanic. For the Hispanic sample, participants went through a screening question asking their race/ethnicity. Those who chose Hispanic as their race/ethnicity (multiple choices were allowed) passed screening as Hispanic. Moreover, the entire survey was written in Spanish. Literature shows that the quality of non-English users' responses can be improved by researchers' cautions such as translating the survey with respondents' first language (Berkanovic, 1980; Santiago-Rivera & Altarriba, 2002). For the non-Hispanic sample, after race/ethnicity were collected, respondents who chose Hispanic were removed. Given researchers aimed for comparable sizes between samples, it took only two days to collect the non-Hispanic sample (January 24 – 25, 2022), whereas seven days passed until we collected a similar sample of Hispanics (February 1-8, 2022).

Table 6.1
Experimental survey hypotheses and research questions

(1) Language and Image Preferences

H1   Hispanic participants are more likely to prefer social media pages featuring Hispanics in the image and Spanish language than non-Hispanic participants.

H2   Hispanic participants are less likely to prefer social media pages featuring non-Hispanics in the image and English language than non-Hispanic participants.

H3   Hispanic participants are more likely to prefer social media pages featuring Hispanics in the image and Spanish language than social media pages featuring with Hispanics in the image and English, non-Hispanic in image and Spanish, and non-Hispanic in the image and English.

H4   Hispanic participants are less likely to prefer social media pages featuring non-Hispanics in the image and English than social media pages featuring Hispanics in the image and Spanish, Hispanics in the image and English, and non-Hispanics in image and Spanish.

(2) Persuasive Messaging Preferences

H5   Hispanic participants are more likely to prefer tailored persuasive messages curated from Hispanic social media and interview data than generic messages from government health sources concerning COVID-19 vaccination.

(3) Narrative Element Preferences

H6   Hispanic migrants who are exposed to culturally tailored narratives are more likely to express COVID-19 vaccine confidence than Hispanic migrants who are exposed to generic narratives, above and beyond the well-documented effect of a variety of perceptions related to the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects).

RQ1   How does each participant's perception of the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects) relate to COVID-19 vaccine confidence?

RQ2   How does each participant's perception of the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects) interact with message type (i.e., culturally tailored narrative vs. generic narrative)?

Participants

Non-Hispanic sample

The non-Hispanic sample dataset was collected via Qualtrics and MTurk. A total of 574 respondents participated between January 24th to 25th 2022. Twenty-five participants who identified as Hispanic were removed from the dataset. We also removed 61 participants who did not complete the entire survey. The result is a total of 488 participants. The non-Hispanic sample included 421 White, 54 Black, 9 Asian, and 13 Native American, with an average age of 38.57 years. Additional information on our non-Hispanic sample is presented on Table 6.2.

Table 6.2
Descriptive characteristics of non-Hispanic sample (N = 488)

Characteristics	N (%)
Age	M = 38.57 (SD = 11.48)
Gender	
Female	210 (38.3)
Male	278 (50.6)
Race/ethnicity	
White/ Caucasian	421 (86.3)
Black or African American	54 (11.1)
Asian	9 (1.8)
Native American	13 (2.7)
Other	4 (.8)
Family income	
Less than $29,999	45 (8.2)
$30,000 - $39,999	73 (13.3)
$40,000 - $49,999	81 (14.8)
$50,000 - $59,999	96 (17.5)
$60,000 - $69,999	52 (9.5)
$70,000 - $79,999	74 (13.5)
$80,000 or more	67 (12.2)
Family structure	
Single	65 (11.8)
Married/living with partner or spouse	258 (47.0)
Married/living with partner or spouse and children	156 (28.4)
Single/divorced with children	8 (1.5)
Other	1 (.2)

Education	
Less than high school	3 (.5)
Graduate high school or equivalent	20 (3.6)
Some college, no degree	31 (5.6)
Associate degree	20 (3.6)
Bachelor's degree	323 (58.8)
Post-graduate degree	91 (16.6)
Party affiliation	
Republican	145 (26.4)
Democrat	273 (49.7)
Independent	58 (10.6)
Libertarian	5 (.9)
No affiliation	3 (.5)
Other/ prefer not to answer	4 (.7)
Religion	
Non-religious	64 (11.7)
Christian	400 (72.9)
Jewish	6 (1.1)
Hindu	6 (1.1)
Buddhist	4 (.7)
Muslim	2 (.4)
Other	6 (1.1)

Hispanic sample

The Hispanic sample dataset was collected via Qualtrics and MTurk. A total of 519 respondents participated between February 1st to 8th 2022. Seventy-one participants were removed for not completing the entire survey, resulting in a total of 448 participants. The average age of Hispanics in the sample was 34.10 years. Additional information on the Hispanic sample is presented on Table 6.3.

Table 6.3
Descriptive characteristics of Hispanic sample (N = 448)

Characteristics	N (%)
Age	M = 34.10 (SD = 10.32)
Gender	
Female	230 (51.3)
Male	215 (48.0)
Other/ prefer not to say	2 (.7)
Race/ethnicity	
Hispanic	448 (100)
Family income	
Less than $29,999	38 (8.5)
$30,000 - $39,999	58 (12.9)
$40,000 - $49,999	64 (14.3)
$50,000 - $59,999	86 (19.2)
$60,000 - $69,999	47 (10.5)
$70,000 - $79,999	91 (20.3)
$80,000 or more	64 (14.3)

Family structure	
Single	107 (23.9)
Married/living with partner or spouse	188 (42.0)
Married/living with partner or spouse and children	125 (27.9)
Single/divorced with children	21 (4.7)
Other	7 (1.6)
Education	
Less than high school	19 (4.2)
Graduate high school or equivalent	37 (8.3)
Some college, no degree	57 (12.7)
Associate degree	92 (20.5)
Bachelor's degree	114 (25.4)
Post-graduate degree	129 (28.8)
Party affiliation	
Republican	100 (22.3)
Democrat	268 (59.8)
Independent	50 (11.2)
Libertarian	8 (1.8)
No affiliation	13 (2.9)
Other/ prefer not to answer	9 (2.0)
Religion	
Non-religious	52 (11.6)
Christian	355 (79.2)
Jewish	6 (1.3)
Hindu	10 (2.2)
Buddhist	3 (.7)
Muslim	4 (.9)
Other	18 (4.0)

Treatments

Experimental social media group pages (1)

We developed the front pages of experimental social media groups resembling Facebook group pages (See Figure D.1 in Appendix D). We manipulated only the cover photos and languages of the front pages and kept the rest of information consistent, such as the number of group members (i.e., 3.7k members) or the openness of the groups (i.e., public group) to ensure differences in preference were a result of treatment manipulations. The group page names were also similar in that all names indicated them as help groups for COVID-19 vaccination; while the exact names varied from "COVID-19 vaccine resource" to "Find a COVID-19 shot" to maximize a sense of reality. The front-page placement of experimental social media groups was randomly rotated across participants; thus, different participants came across each page in different positions, limiting the possibility of confound effects.

The three group pages on the left-side of Figure D.1 show the Hispanic images used as group page cover photos. The cover photos with non-Hispanic images are the three on the right-side of Figure D.1. The group pages using Spanish were "Vacunas y Vacunación COVID-19," and "CAMPAÑAS DE VACUNACIÓN." The group pages using English included "Find a COVID-19 shot," "COVID-19 vaccine resource," "COVID-19 Information Center," and "COVID-19 vaccine for children." All the social media group names were taken from existing Facebook groups. As treatments, the social media page with (1) Hispanic image and Spanish is titled "Vacunas y Vacunación COVID-19," whereas social media pages with (2) Hispanic image with English are titled "Find a COVID-19 shot," and "COVID-19 Information Center." The social media page with (3) non-Hispanic image and Spanish is titled "CAMPAÑAS DE VACUNACIÓN," social media pages with (4) non-Hispanic image and English are "COVID-19 vaccine resource" and "COVID-19 vaccine for children."

Participants were asked to respond with the extent to which they were willing to get help from each of social media group pages with the following question: "please rate your preference of where you would like to get some help related to the COVID-19 vaccine for each group" (1 = *strongly not prefer* to 7 = *strongly prefer*).

Experimental persuasive messages (2)

As mentioned in the methodology section (experimental survey), sixteen expressions of tailored vaccine confidence were produced focusing on important themes from the data concerning COVID-19 vaccination (e.g., return to normalcy, social responsibility, absorbing risk for protection, obligation to work and family, collectivism, mistrust of government, expense, etc.). These statements were organized around prominent themes in social media and interview data and were contrasted to generic control statements issued by the CDC and other health organizations on similar topics or focus points related to COVID-19 vaccination. In most cases, thematic statements were direct, or slightly modified, quotes from the collected project data, while contrasting statements were pulled from the social media pages of the CDC and other prominent government healthcare services. For two of the thematic sets of statements (i.e., government mistrust and obligation to vaccinate) the generic contrast statements were created by the researchers because no equivalent could be located from government health services.

Experimental culturally tailored narratives (3)

Following the designs and content of previous studies (Alden, Friend, Fraenkel, & Jibaja-Weiss, 2018), two different narratives on the COVID-19 vaccine were developed: a culturally tailored narrative (Figure D.2 in Appendix D) vs. generic narrative (Figure D.4 in Appendix D). The culturally tailored narrative was aimed to middle age, lower-middle and middle class Hispanics living in the U.S. via references to: culturally relevant visual imagery, Hispanic names for spokespersons, thematic concerns specific to Hispanics such as family and community, and guilt in causing harms to others (Alden et al., 2018), as well as findings from social media and interview data. The generic narrative was focused on self, work, and

personal pain without reference to culturally collective themes. Other information such as the length, tone, and overall storyline were presented consistently across the two narratives. Measurements were taken from participants on the following scaled items concerning COVID-19 vaccination:[9]

COVID-19 vaccine confidence
Participants were asked to provide their agreement with the following three statements on a 7-point scale (*strongly disagree* = 1 to *strongly agree* = 7): "for yourself, getting the COVID-19 vaccine is valuable," "for yourself, getting the COVID-19 vaccine is important," and "for yourself, getting the COVID-19 vaccine is pleasant." The scores of the three items were averaged to construct the COVID-19 vaccine confidence variable (M = 5.14, SD = 1.42, Cronbach alpha = .89).[10]

Perceived susceptibility
Participants were asked to assess how much they agree with the following two statements on a 7-point scale (*strongly disagree* = 1 to *strongly agree* = 7): "It is likely that I will contract COVID-19," "I am at risk for getting COVID-19." The scores of the two items were averaged to construct the susceptibility variable (M = 5.17, SD = 1.38, a = .74).

Perceived severity
Participants were asked how much they agree with the following two statements on a 7-point scale (*strongly disagree* = 1 to *strongly agree* = 7): "I believe that contracting COVID-19 causes serious negative consequences" and "I believe that COVID-19 is extremely harmful." The scores of the two items were averaged to construct the severity variable (M = 5.35, SD = 1.30, a = .79).

Perceived benefits
Participants were asked how much they agree with the following two statements on a 7-point scale (*strongly disagree* = 1 to *strongly agree* = 7): "COVID-19 vaccines are effective" and "COVID-19 vaccine are trustworthy" The scores of the two items were averaged to construct the severity variable (M = 5.47, SD = 1.42, a = .89).

Perceived barriers
Participants were asked how much they agree with the following two statements on a 7-point scale (*strongly disagree* = 1 to *strongly agree* = 7): "Getting the COVID-19 is convenient" and "COVID-19 vaccines are affordable." The two items were recoded to indicate higher numbers to a higher degree of perceived barrier. The recoded scores of the two items were averaged to construct the barrier variable (M = 2.47, SD = 1.23, a = .74).

Perceived side effects
Participants were asked how much they agree with the following two statements on a 7-point scale (*strongly disagree* = 1 to *strongly agree* = 7): "I worry about the short-term side effects of the COVID-19 vaccine," "I worry that the COVID-19 vaccine might have unknown long term side effects." The scores of the two items were averaged to construct the perceived side effects variable (M = 5.09, SD = 1.61, a = .92).

Control variables
Demographic characteristics were included in the analysis — age, gender, education, and household income. Race/ethnicity was not included because all the participants were identified as Hispanic. Importantly, we also included an additional variable that may be directly related to the COVID-19 vaccine confidence, which is individual COVID-19 vaccine uptake status with the following statement on a 4-point scale (1 = No, I haven't been vaccinated, 2 = Yes, only first dose, 3 = Yes, first dose and second dose, and 4 = Yes, first dose, and second dose, as well as a booster): "Have you received a COVID-19 vaccine shot?" (M = 3.18, SD = .90). We recoded this item with 1 being vaccinated (n = 408) and 0 having not been vaccinated (n = 40).

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[9] Note, all of these variables on perceptions (i.e., perceived susceptibility, severity, benefit, barrier, side effects) were each measured before exposure to the experimental manipulations and were adapted from prior research (e.g. Nan & Kim, 2014).

[10] Note, these items were measured after the participants were exposed to the manipulations.

Results

Language and image preferences (1)

Hypothesis 1. Hispanic participants are more likely to prefer social media pages featuring Hispanics in the image and Spanish language than non-Hispanic participants.

To answer H1, an analysis of variance was conducted with participant ethnicity (Hispanic vs. non-Hispanic) as a between-group factor and preference for the social media page featuring Hispanics in the image and Spanish as an outcome. A significant impact of the between-group factor emerged, $F(1, 935) = 39.87$, $p < .001$, $h^2 = 89.44$, indicating Hispanic participants preferred the social media page featuring Hispanics in the image and Spanish ($M = 5.52$, $SD = 1.28$) than did non-Hispanics ($M = 4.91$, $SD = 1.67$) as shown in Table 6.4 and Figure 6.1. Thus, H1 was supported.

Hypothesis 2. Hispanic participants are less likely to prefer social media pages featuring non-Hispanics in the image and English language than non-Hispanic participants.

To answer H2, an analysis of variance was conducted with participant ethnicity (Hispanic vs. non-Hispanic) as a between-group factor and preference for the social media page featuring non-Hispanics in the image and English as an outcome. A significant impact of the between-group factor emerged, $F(1, 935) = 7.29$, $p < .01$, $h^2 = 9.93$, indicating Hispanic participants had lower preference for the social media page featuring non-Hispanics in the image and English ($M = 5.22$, $SD = 1.27$) than did non-Hispanics ($M = 5.43$, $SD = 1.06$) as shown in Table 6.4 and Figure 6.1. Thus, H2 was supported.

Hypothesis 3. Hispanic participants are more likely to prefer social media pages featuring Hispanics in the image and Spanish language than social media pages featuring with Hispanics in the image and English, non-Hispanic in image and Spanish, and non-Hispanic in the image and English.

To answer H3, an analysis of variance was conducted with the extent to which participants preferred social media pages featuring Hispanic in the image and Spanish, Hispanics in the image and English, non-Hispanics in the image and Spanish, and non-Hispanics in the image and English as repeated measures among Hispanic participants only. Our results showed that Hispanic participants did not prefer social media pages featuring Hispanics in the image and Spanish ($M = 5.52$, $SD = 1.28$) compared to Hispanics in the image and English ($M = 5.51$, $SD = 1.10$; $p = .90$). However, our findings showed that Hispanic participants had more preference for social media pages featuring Hispanics in the image and Spanish ($M = 5.52$, $SD = 1.28$) compared to non-Hispanics in the image and Spanish ($M = 5.29$, $SD = 1.46$; $p < .01$) and non-Hispanics in the image and English ($M = 5.22$, $SD = 1.27$; $p < .001$) as presented in Table 6.4 and Figure 6.1. Thus, H3 was partially supported.

Hypothesis 4. Hispanic participants are less likely to prefer social media pages featuring non-Hispanics in the image and English than social media pages featuring Hispanics in the image and Spanish, Hispanics in the image and English, and non-Hispanics in image and Spanish.

To answer H4, an analysis of variance was conducted with the extent to which participants prefer social media pages featuring Hispanics in the image and Spanish, Hispanics in the image and English, non-Hispanics in the image and Spanish, and non-Hispanics in the image and English as repeated measures among Hispanic participants only. Our findings showed that Hispanic participants had significantly less preference for social media pages featuring non-Hispanics in the image and English ($M = 5.22$, $SD = 1.27$) compared to Hispanics in the image and Spanish ($M = 5.52$, $SD = 1.28$; $p < .001$) and Hispanics in the image and English ($M = 5.51$, $SD = 1.10$; $p < .001$) as presented in Table 6.4 and Figure 6.1. However, our results showed that Hispanic participants did not have less preference for social media pages featuring non-Hispanics in the image and English ($M = 5.22$, $SD = 1.27$) compared to non-Hispanics in the image and Spanish ($M = 5.29$, $SD = 1.46$; $p = .29$). Thus, H4 was partially supported.
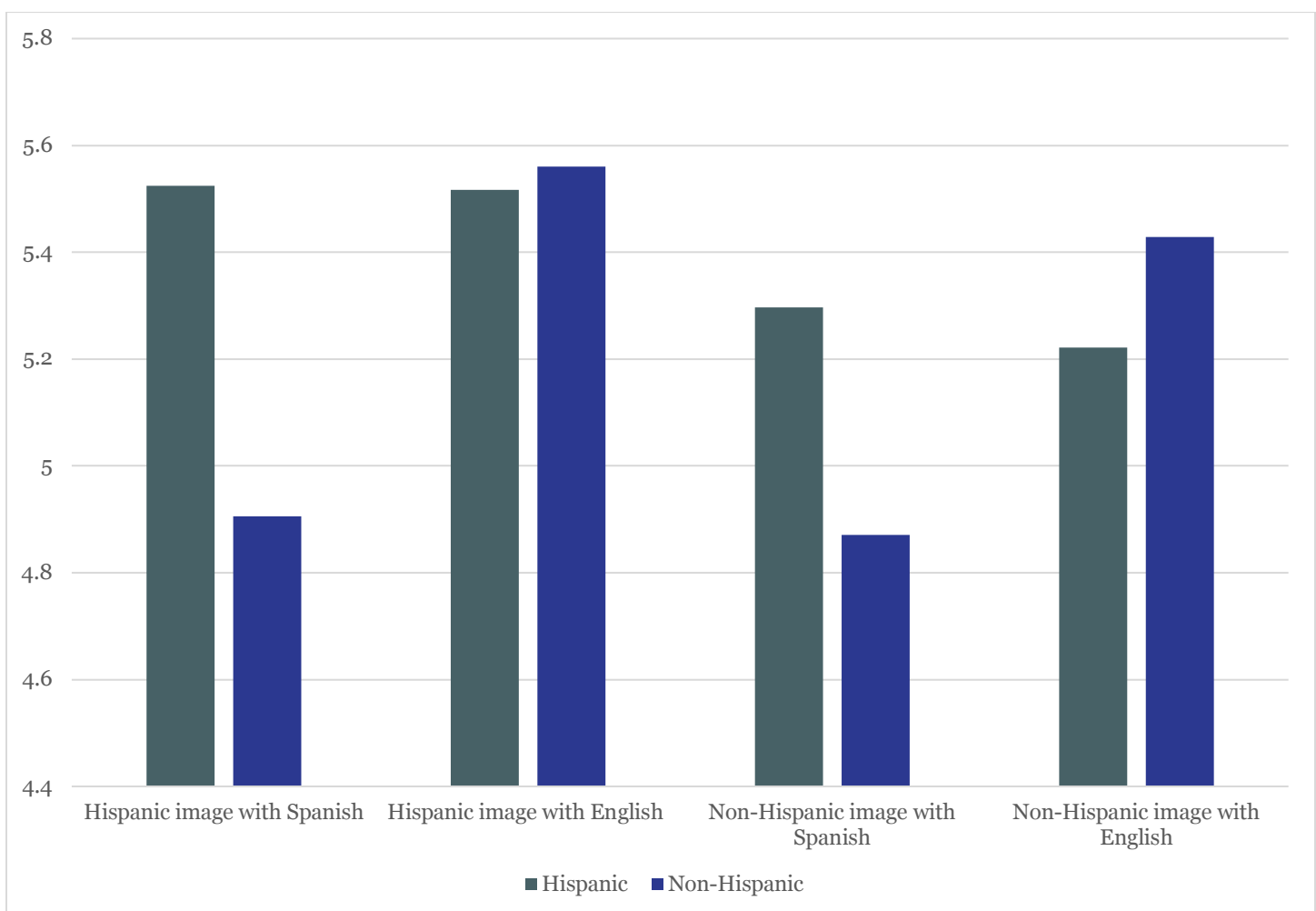
Table 6.4

Comparison of willingness to get help from social media pages featured with Hispanic images and Spanish, Hispanic image and English, non-Hispanic image and Spanish, and non-Hispanic image and English by participants' ethnicity

	Hispanic (n = 448)		Non-Hispanic (n = 488)	
	M	*SD*	*M*	*SD*
A social media page featured with Hispanic image and Spanish	5.52	1.28	4.91	1.67
A social media page featured with Hispanic image and English	5.51	1.10	5.56	1.02
A social media page featured with non-Hispanic image and Spanish	5.29	1.46	4.87	1.73
A social media page featured with non-Hispanic image and English	5.22	1.27	5.43	1.06

Figure 6.1. Comparison of willingness to get help from social media pages featured with Hispanic images and Spanish, Hispanic image and English, non-Hispanic image and Spanish, and non-Hispanic image and English by participants' ethnicity

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Persuasive messaging preferences (2)

Hypothesis 5. Hispanic participants are more likely to prefer tailored persuasive messages curated from Hispanic social media and interview data than generic messages from government health sources concerning COVID-19 vaccination.

To answer H5 a one-sample t-test using only the Hispanic participant group (n=448) was conducted between each of the tailored persuasive messages and its generic government health source counterpart concerning COVID-19 vaccination. Overall, six of the tailored messages were perceived as significantly more persuasive [marked in blue], eight of the pairs showed no significant difference between tailored and generic [marked in grey], and two of the generic messages outperformed the tailored messages

[marked in red]. Therefore, the hypothesis is partially supported. The statistical comparison of each pair of messages is presented below.

The first set of statements examined the more persuasive message on the theme of a return to normal, a significant impact of the one-sample t-test emerged, $t(1, 447) = -9.40$, $p < .001$. Hispanic participants perceived the tailored statement of "I would get vaccinated or boosted so that I could attend important social events with my family and community members (viz. Christmas, New Year's, birthdays, etc.)" more persuasive ($n = 315$) than the generic statement "I would get vaccinated or boosted so that I can travel to destinations I am interested in" ($n = 133$) as shown in Figure 6.2.
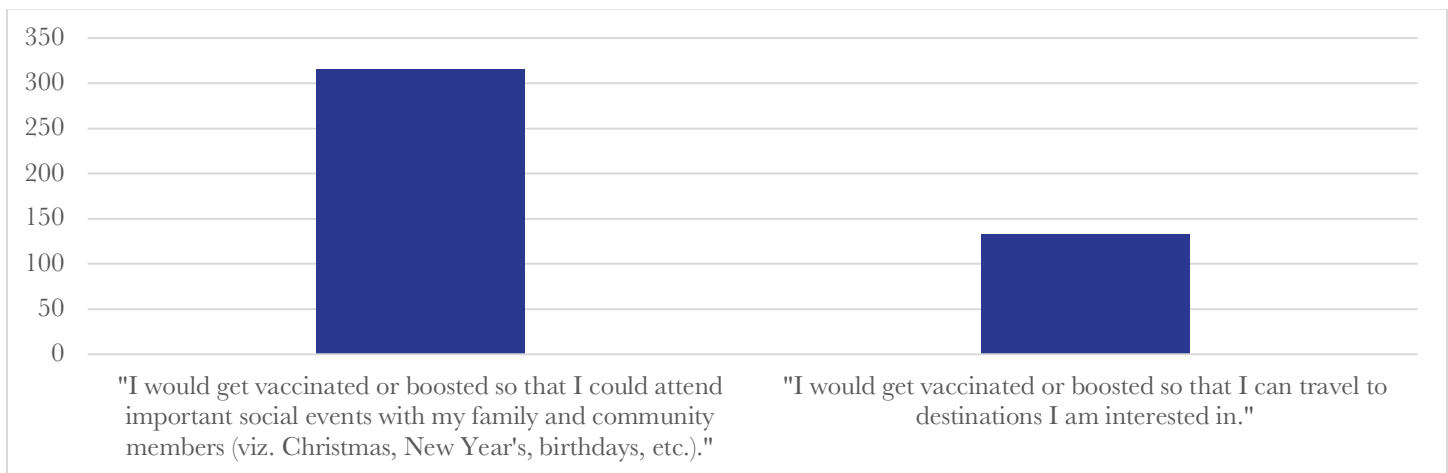
Figure 6.2. Return to normal statements

The second set of statements examined the theme of "responsibility," a significant impact of the one-sample t-test emerged, $t(1, 447) = 2.86$, $p < .01$. Hispanic participants perceived the tailored statement of "It is my responsibility to make sure members of my community don't get sick, that is why I would get vaccinated or boosted" less persuasive ($n = 194$) than the generic statement ""COVID-19 vaccines are shown to be working well to prevent severe illness, hospitalization, and death, that is why I would get vaccinated or boosted" ($n = 254$) as shown in Figure 6.3.

The third set of statements examined the theme of "vaccine comparison," a significant impact of the one-sample t-test emerged, $t(1, 447) = -4.34$, $p < .001$. Hispanic participants perceived the tailored statement of "Even though everyone's body reacts differently, vaccines have a long history of saving lives against tetanus, polio, smallpox, measles, and other diseases. COVID-19 vaccines save lives by helping the body fight the virus, no different from vaccines" more persuasive ($n = 269$) than the generic statement "Even though everyone's body reacts differently, after a COVID-19 vaccine, non-serious side effects, like arm pain or brief tiredness are common and a sign that your body is building protection against COVID-19 illness" ($n = 179$) as shown in Figure 6.4.
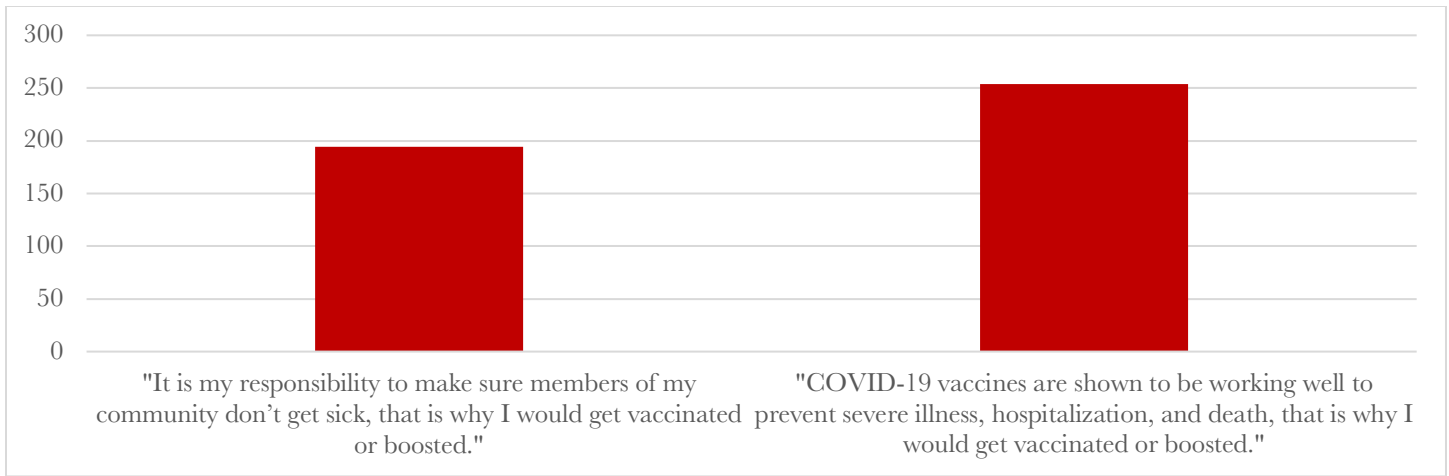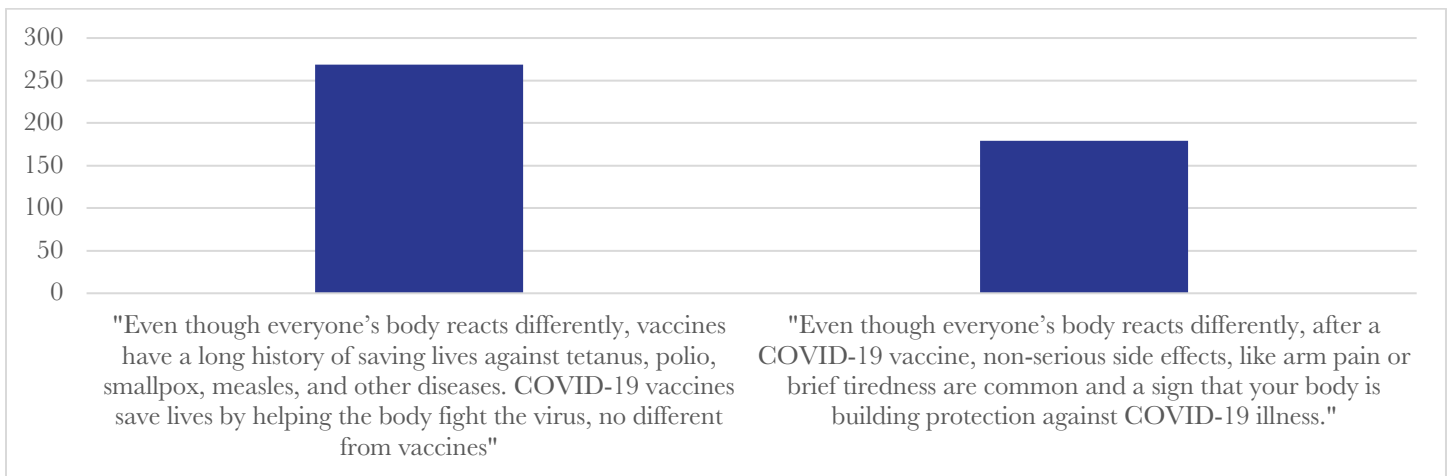
Figure 6.3. Responsibility statements

Figure 6.4. Vaccine comparison statements

The fourth set of statements examined the theme "end of pandemic," there was no significant impact, $t(1, 447) = -1.13$, $p = .13$. There was no difference between the persuasiveness of the tailored "Rather than believing in conspiracy theories, I trust the science behind COVID-19 vaccines. I would get the vaccine or booster to do my part to help end this pandemic" ($n = 236$) and the generic "To help stop the spread of misinformation, I tap into credible sources to help bust myths and learn the facts about COVID-19 vaccines. That is why I would choose to get vaccinated or boosted" ($n = 212$) as shown in Figure 6.5.

The fifth set of statements examined the theme of "provide protection/ reduce risk," a significant impact of the one-sample t-test emerged, $t(1, 447) = -3.84$, $p < .001$. Hispanic participants perceived the

tailored statement of "COVID-19 vaccines provide the body protection to help fight the virus and keep symptoms under control. It's not supernatural immunity, but getting vaccinated or boosted, wearing a mask, and washing your hands, are all part of a larger effort to stop" more persuasive ($n = 264$) than the generic statement "It is vital people get vaccinated, stay home and test when sick, and adhere to recommended masking in order to reduce the spread of COVID-19" ($n = 184$) as shown in Figure 6.6.

The sixth set of statements examined the theme of "responsibility," there was no significant impact, $t(1, 447) = .57$, $p = .29$ between the persuasiveness of tailor "Getting vaccinated and boosted helps protect my coworkers and community from getting sick and being burdened by the costs and hassles of doctor

visits and missing work" ($n = 218$) and generic "More than 242.4 million people have received at least one dose of a COVID-19 vaccine. Of those, 205.2 million are fully vaccinated. More than 66.4 million people have received a COVID-19 booster. Like others, I should get vaccinated and boosted" (n = 230) as shown in Figure 6.7.
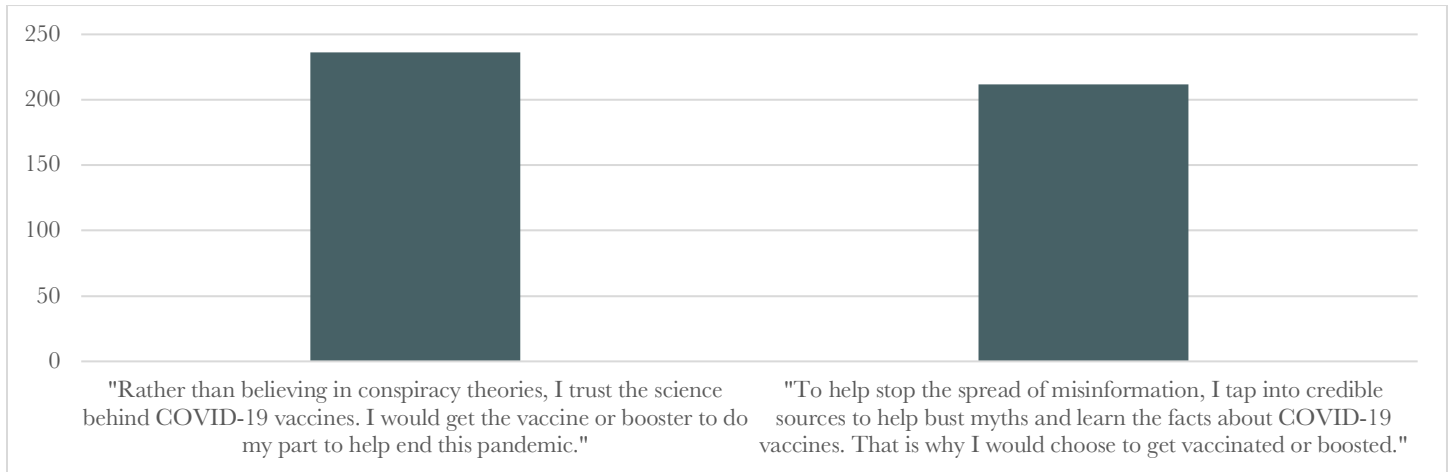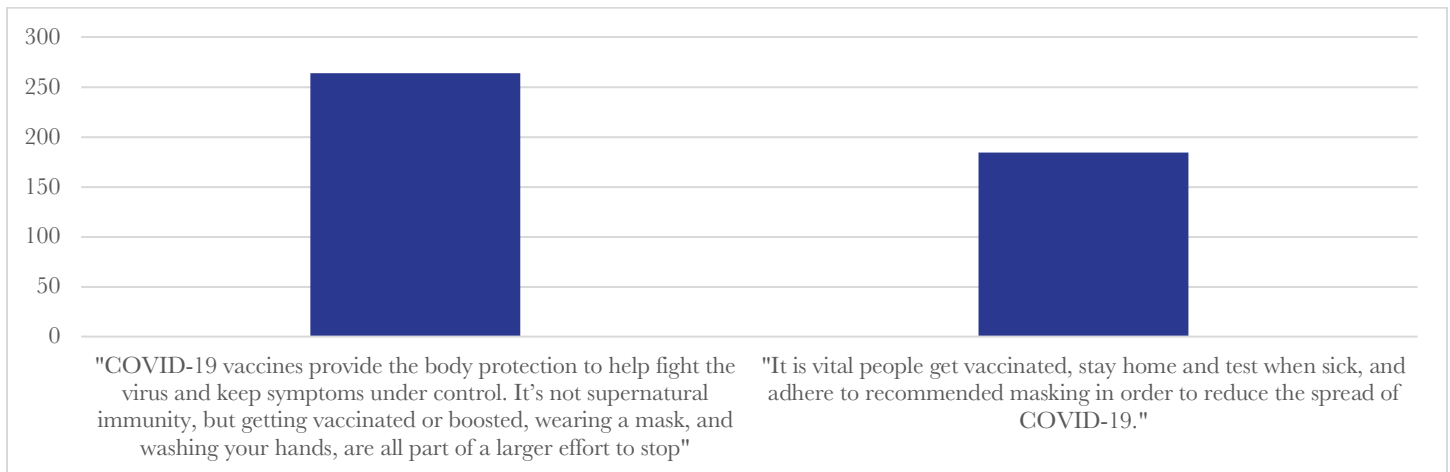

Figure 6.5. End of pandemic statements

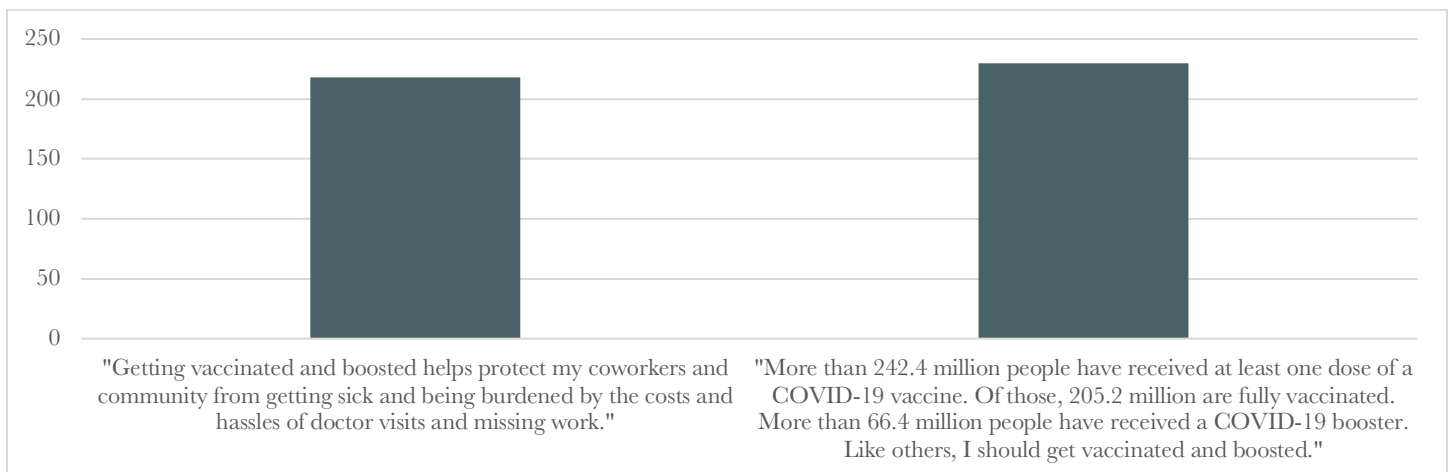

Figure 6.6. Provide protection/reduce risk statements

Figure 6.7. Responsibility statements

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The seventh set of statements examined the theme of "obligation to vaccinate: employer vs government," a significant impact of the one-sample t-test emerged, $t(1, 447) = -3.35$, $p < .001$. Hispanic participants perceived the tailored statement of "I would get the COVID-19 vaccine or booster if my employer required it" more persuasive ($n = 259$) than the statement "I would get the COVID-19 vaccine or booster if there were a federal government mandate to do so" (n = 189) as shown in Figure 6.8.

The eighth set of statements examined the theme of "personal experience," a significant impact of the one-sample t-test emerged, $t(1, 447) = -3.35$, $p < .001$. Hispanic participants perceive the tailored statement of "After seeing my family and friends get sick, be hospitalized, or even die from COVID-19, I would

choose to get the COVID-19 vaccine" more persuasive ($n = 256$) than the generic statement "I don't want, 'I should have gotten vaccinated' to be my last words. That is why I would choose to get the COVID-19 vaccine" (n = 192) as shown in Figure 6.9.

The ninth set of statements examined the theme of "cultural collectivism," there was no significant difference, $t(1, 447) = -.57$, $p = .29$ between the tailored message "I would get the COVID-19 vaccine or booster if my parents, siblings or other family members asked me to do so" ($n = 230$) and generic "Getting vaccinated and boosted is the most powerful protection you can get against COVID-19 and its variants" (n = 218) as shown in Figure 6.10.
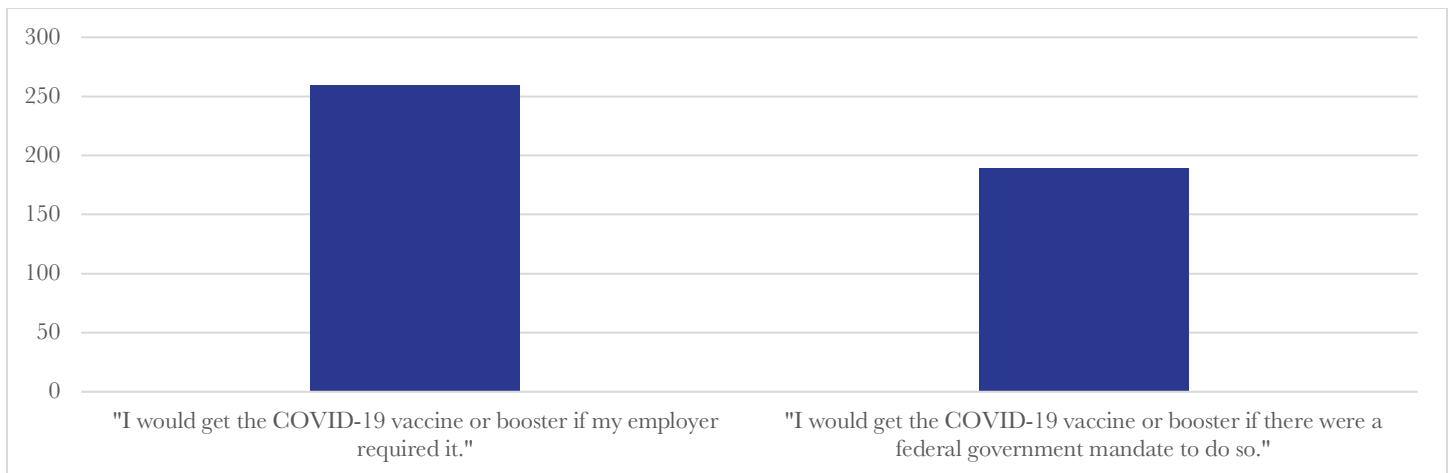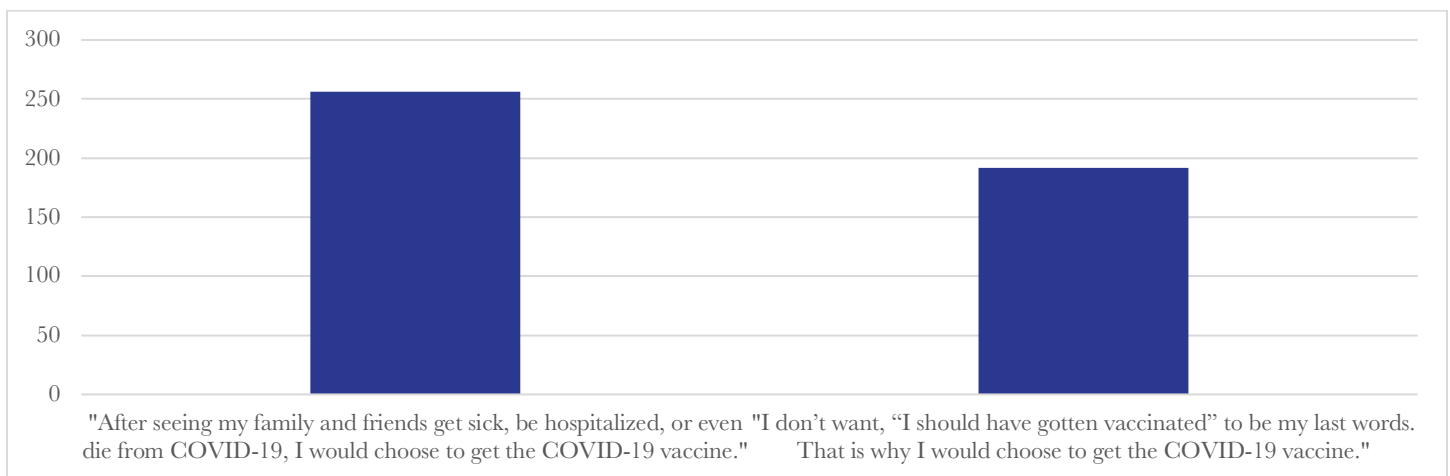

Figure 6.8. Obligation to vaccinate statements

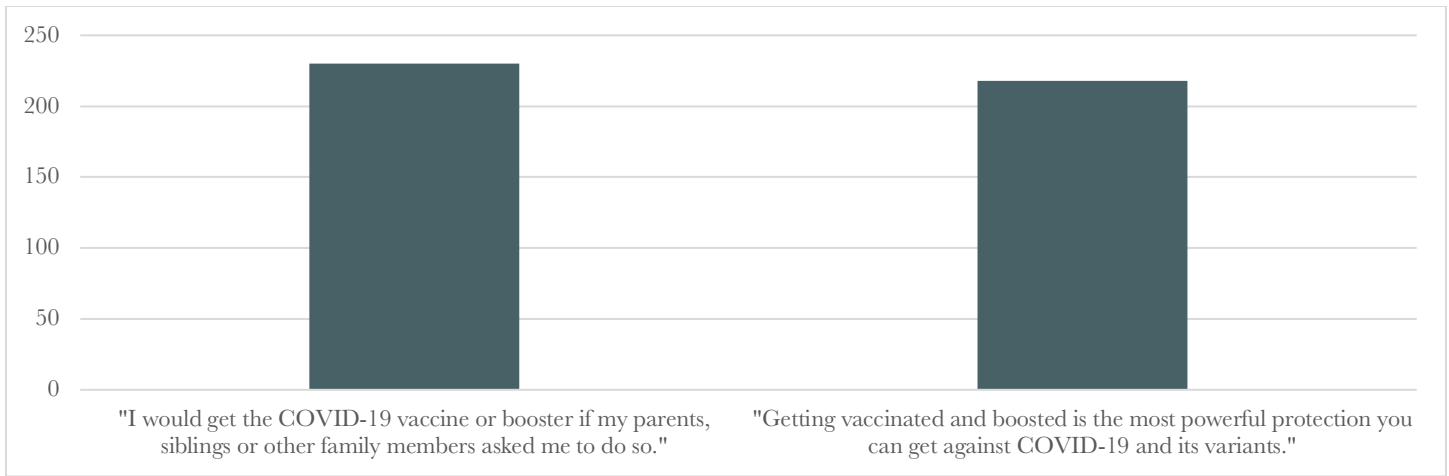*Figure 6.9. Personal experience statements*

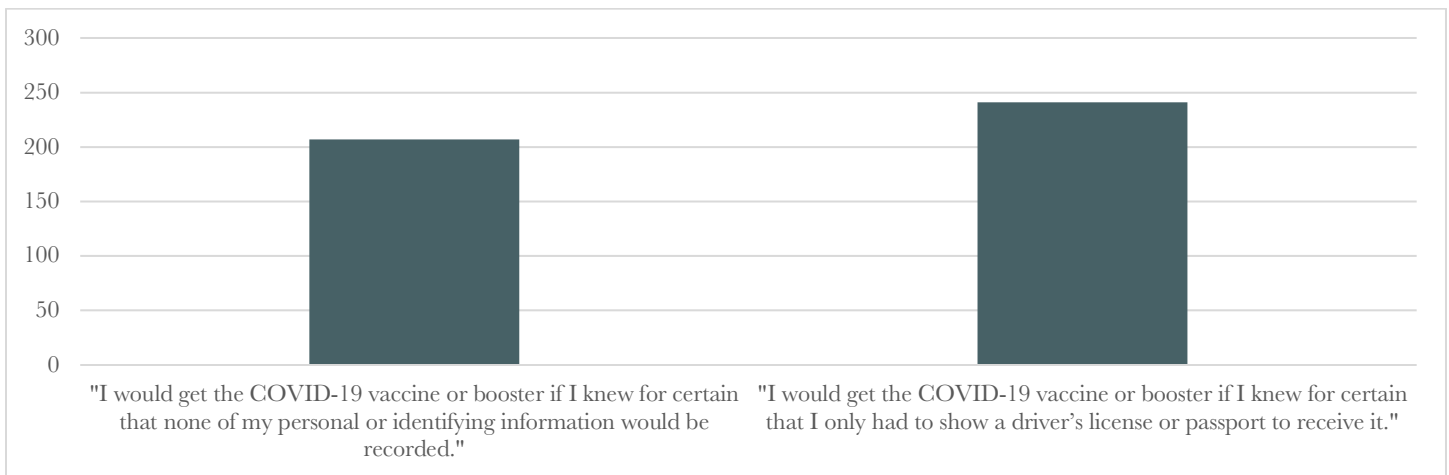*Figure 6.10. Cultural collectivism statements*

Figure 6.11. Government mistrust statements

The tenth set of statements examined the theme of "government mistrust," there was no significant difference, $t(1, 447) = 1.61$, $p = .05$ between the persuasiveness of the tailored message "I would get the COVID-19 vaccine or booster if I knew for certain that none of my personal or identifying information would be recorded" ($n = 207$) and generic "I would get the COVID-19 vaccine or booster if I knew for certain that I only had to show a driver's license or passport to receive it" (n = 241) as shown in Figure 6.11.

The eleventh set of statements examined the theme of "expense," there was no significant difference, $t(1, 447) = -.38$, $p = .35$ between the persuasiveness of the tailored message "Needing hospitalization for COVID-19 would be very expensive for me and my family, so I would get the COVID-19 vaccine or booster to avoid the costs of hospitalization and damage it would cause to my family's finances" ($n = 228$) and the generic "Hospital stays can be expensive, but COVID-19 boosters and vaccines are free. Help protect yourself from being hospitalized with COVID-19 by getting vaccinated and boosted" (n = 220) as shown in Figure 6.12.

The twelfth set of statements examined the theme of "accessibility: institutional mistrust," there was no significant difference, $t(1, 447) = -1.23$, $p = .11$ between the persuasiveness of the tailored message "I would get the COVID-19 vaccine or booster if it were available at easily accessible pop-up tents outside of places I shop and work" ($n = 237$) and generic "I would get the COVID-19 vaccine or booster if it were available and easily accessible at hospitals" (n = 211) as shown in Figure 6.13.
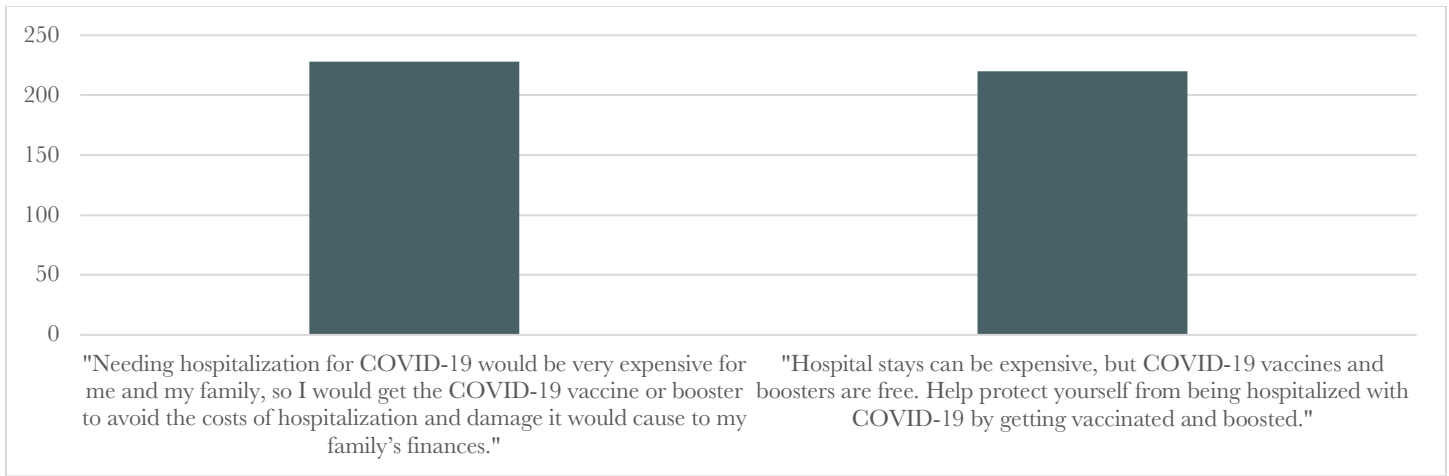
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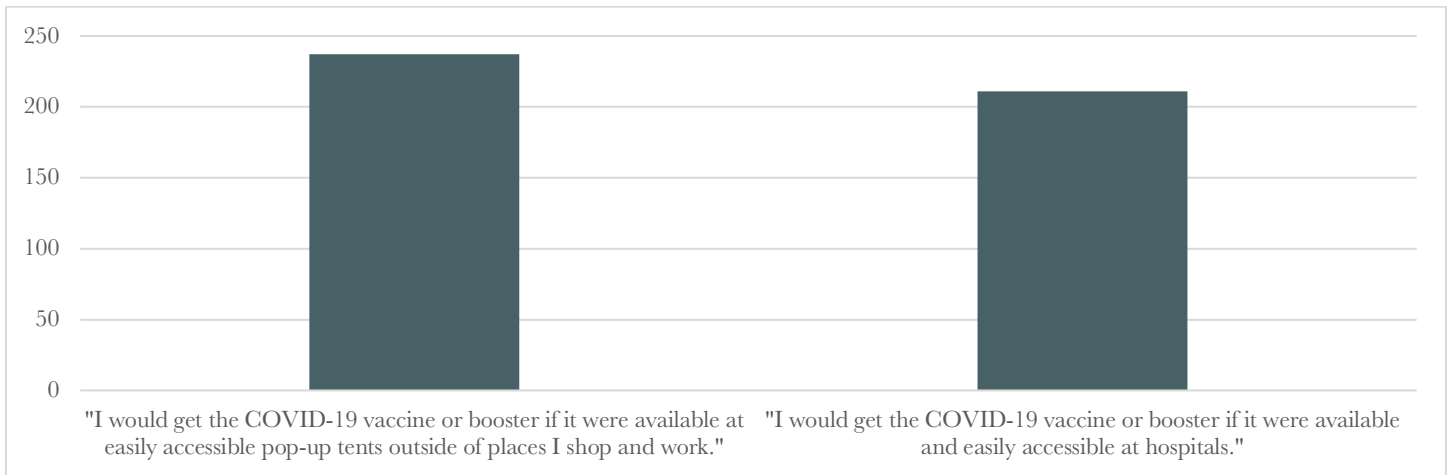
Figure 6.12. Expense statements

Figure 6.13. Accessibility statements

The thirteenth set of statements examined the theme of "health professional trust," a significant impact of the one-sample t-test emerged, $t(1, 447) = -3.25$, $p < .001$. Hispanic participants perceive the tailored statement "I would get the COVID-19 vaccine or boosters if doctors, nurses, and other health professionals like me advocate for it" more persuasive ($n = 258$) than the generic statement "I would get the COVID-19 vaccine or boosters because health care professionals, like those from Harvard, advocate for it" (n = 190) as shown in Figure 6.14.

The fourteenth set of statements examined the theme of "risk benefit," there was no significant difference, $t(1, 447) = -1.23$, $p = .11$ between the persuasiveness of the tailored message "I would get vaccinated or boosted because the risk of missing work or infecting my family outweighs the costs of side effects from the

COVID-19 vaccine" ($n = 206$) and generic "I would get vaccinated or boosted because the risk of missing work or infecting my family outweighs the costs of side effects from the COVID-19 vaccine" (n = 242) as shown in Figure 6.15.

The fifteenth set of statements examined the theme of "information availability," there was no significant difference, $t(1, 447) = -.85$, $p = .20$ between the persuasiveness of the tailored message "I would get vaccinated if more scientific information on the COVID-19 vaccine were available to me in my language" ($n = 233$) and the generic "Don't let a fear of needles get in the way of getting needed protection by vaccines. Learn how to manage your concerns; your family and healthcare providers can help provide information" (n = 215) as shown in Figure 6.16.
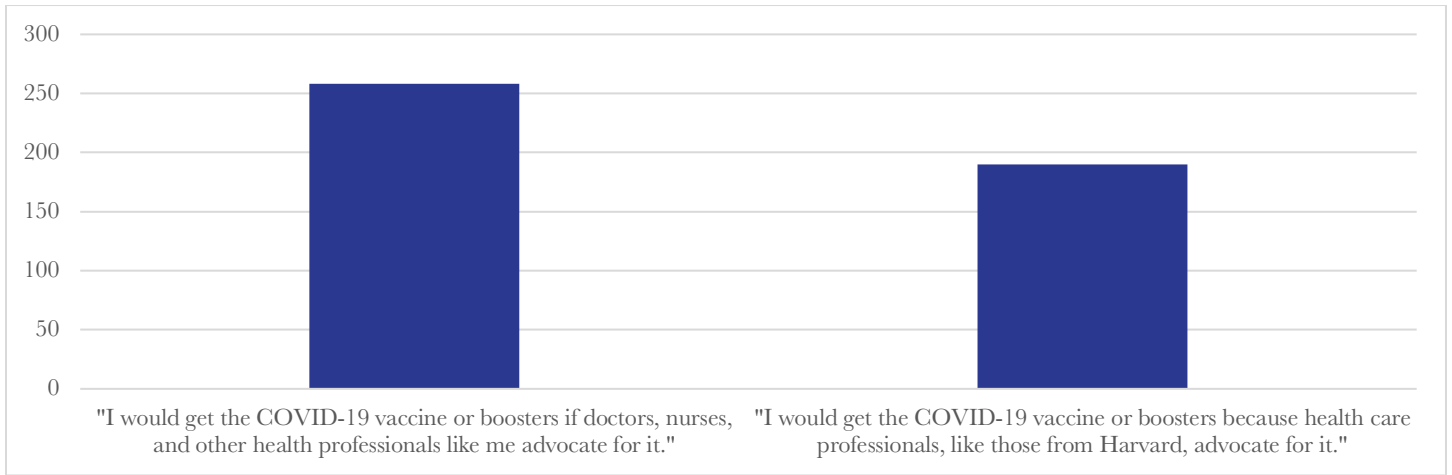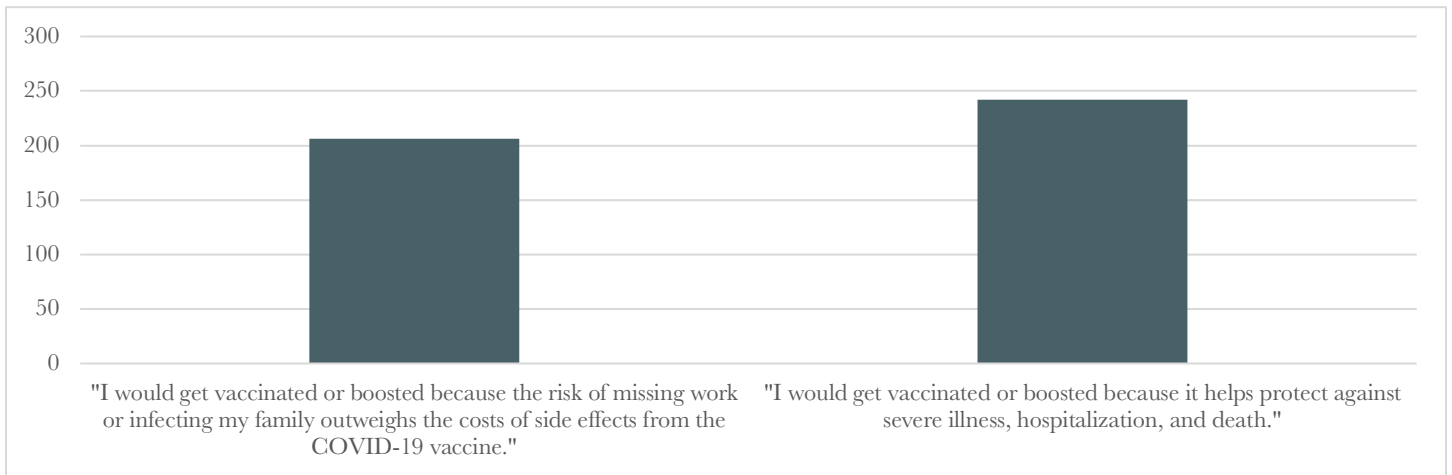
Figure 6.14. Health professional trust statements
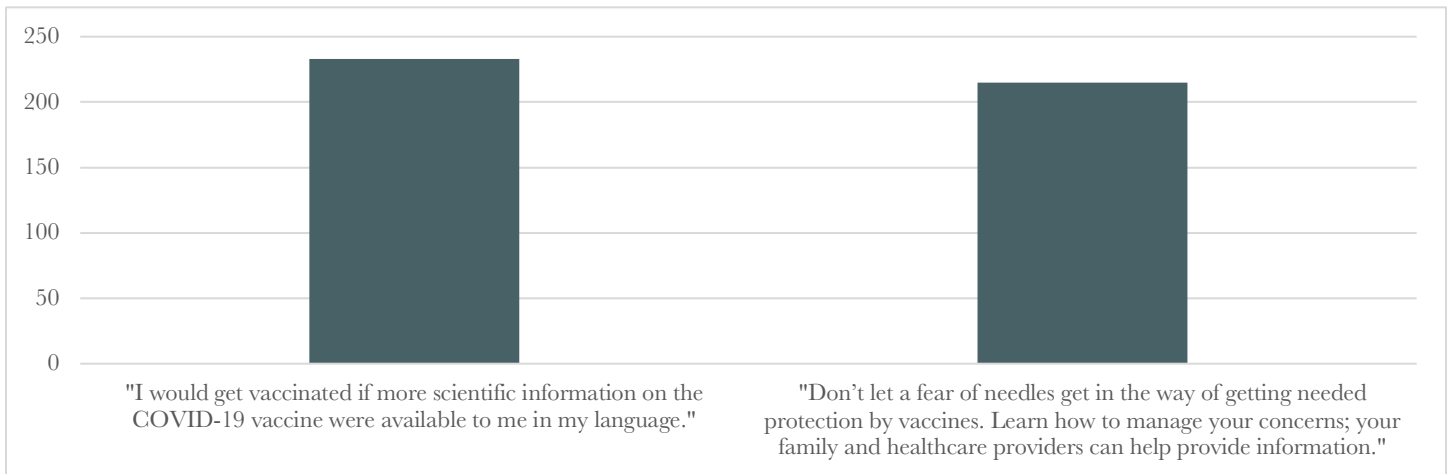

Figure 6.15. Risk/benefit statements

Figure 6.16. Information availability statements

The sixteenth set of statements examined the theme of "belief in science," a significant impact of the one-sample t-test emerged, $t(1, 447) = 3.35$, $p < .001$.

Hispanic participants perceived the tailored message "I would get the COVID-19 vaccine and boosters because I trust science" was less persuasive ($n = 189$)

than the generic statement "The COVID-19 vaccines and boosters have been shown to provide a great deal of protection against serious illness due to COVID-19" (n = 259) as shown in Figure 6.17.
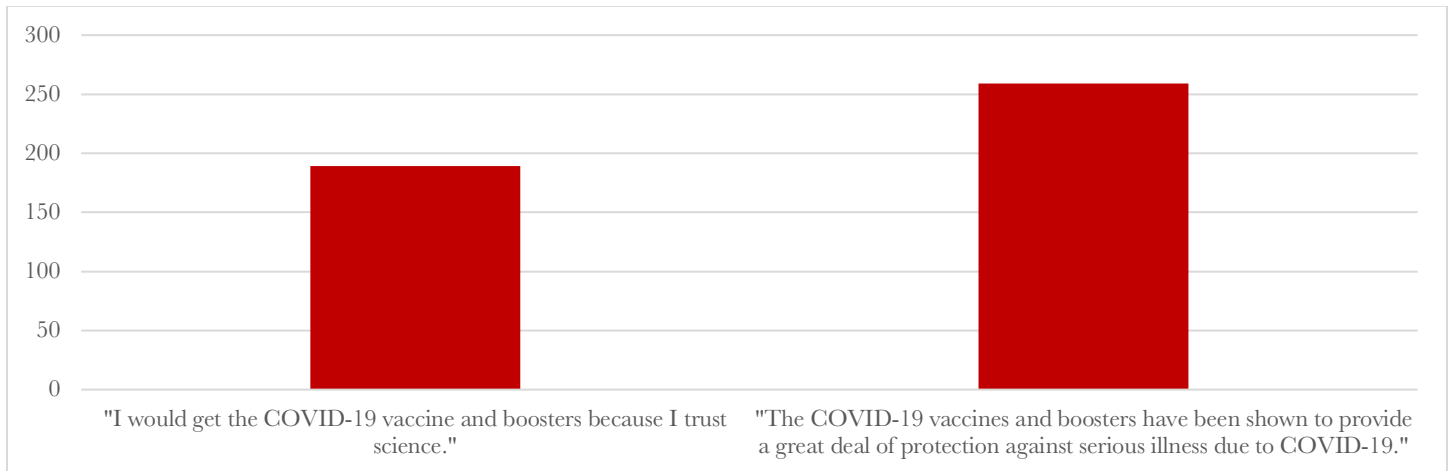

Figure 6.17. Belief in science statements

Narrative element preferences (3)

Two hierarchical linear regression analyses were performed to examine the proposed hypotheses and research questions. The analysis was conducted in four steps: COVID-19 vaccine confidence was entered as a continuous dependent variables; control variables including demographics and COVID-19 vaccine uptake status were entered in Step 1; perception variables concerning COVID-19 vaccination was entered in Step 2; a narrative condition as a binary variable was entered in Step 3; finally, the interactions between the narrative condition and each participant's perception on COVID-19 vaccination were entered in Step 4. Two models were then built. Model A included Steps 1, 2 and 3. Model B included Steps 1, 2, 3 and 4.

The mean age of respondents was 34.1 and slightly more than half of the participants were female (n = 230, 51.3%). All respondents were Hispanic (N = 448, 100%). The majority of respondents were vaccinated at least first dose and second dose (n = 381, 85.1%) and only less than 10% of participants haven't been vaccinated (n = 40, 8.9%). Additional information on descriptives is presented in Table 6.5. Bivariate Pearson correlations among primary variables included in this analysis are presented in Table 6.6. Most HBM constructs were significantly

related to vaccine confidence, with susceptibility ($r = .58$, $p < .001$), severity ($r = .33$, $p < .001$), and benefit ($r = .11$, $p < .05$) showing positive association, and with barrier ($r = -.21$, $p < .001$) showing negative association.

Hypothesis 6. Hispanic migrants who are exposed to culturally tailored narratives are more likely to express COVID-19 vaccine confidence than Hispanic migrants who are exposed to generic narratives, above and beyond the well-documented effect of a variety of perceptions related to the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects).

The effects of narrative type (i.e., culturally tailored narrative vs. generic narrative) on COVID-19 vaccine confidence was examined to test Hypothesis 6. A statistically significant effect of culturally tailored narrative on COVID-19 vaccine confidence emerged ($b = -.074$, $p < .01$) as shown in Table 6.7. This means that participants who were randomly assigned to the treatment group, thus being exposed to the culturally tailored narrative, were more likely to be confident in the COVID-19 vaccine: above and beyond the effect of a variety of perceptions related to the COVID-19 vaccine. Thus, H6 was supported.

Table 6.5
Demographic characteristics and Covdi-19 vaccine uptake status among participants (n = 448)

Characteristics	N (%)
Age	M = 34.10 (SD = 10.32)
Gender	
Female	230 (51.3)
Male	215 (48.0)
Other/ prefer not to say	2 (.7)
Race/ethnicity	
Hispanic	448 (100)
Family income	
Less than $29,999	38 (8.5)
$30,000 - $39,999	58 (12.9)
$40,000 - $49,999	64 (14.3)
$50,000 - $59,999	86 (19.2)
$60,000 - $69,999	47 (10.5)
$70,000 - $79,999	91 (20.3)
$80,000 or more	64 (14.3)
Education	
Less than high school	19 (4.2)
Graduate high school or equivalent	37 (8.3)
Some college, no degree	57 (12.7)
Associate degree	92 (20.5)
Bachelor's degree	114 (25.4)
Post-graduate degree	129 (28.8)
COVID-19 vaccine status	
Yes, first dose, second dose, and a booster	189 (42.2)
Yes, first dose, and second dose	192 (42.9)
Yes, only first dose	27 (6.0)
No	40 (8.9)

Table 6.6
Descriptive statistics and correlations

	M	SD	1	2	3	4	5	6
1. Susceptibility	5.17	1.38	—					
2. Severity	5.35	1.30	.51***	—				
3. Benefit	5.47	1.42	.43***	.63***	—			
4. Barrier	2.47	1.23	-.41***	-.60***	-.77***	—		
5. Side effect	5.09	1.61	.58***	.33***	.11*	-.21***	—	
6. Vaccine confidence	5.13	1.42	.40*	.58***	.83***	-.73***	.10	—

Note. *p < .05, ***p < .001.

Research Question 1. How does each participant's perception of the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects) relate to COVID-19 vaccine confidence?

Research Question 2. How does each participant's perception of the COVID-19 vaccine (i.e., perceived susceptibility, perceived severity, perceived benefit, perceived barrier, and perceived side effects) interact with message type (i.e., culturally tailored narrative vs. generic narrative)?

The relationships between each participant's perception related to the COVID-19 vaccine and their confidence in the COVID-19 vaccine were examined. Results show that perceived benefit (b = .594, p < .001) was positively related to COVID-19 vaccine confidence, whereas perceived barrier (b = -.230, p < .001) was negatively related to COVID-19 vaccine confidence (see Table 6.7). This means that the more people perceived the benefit of COVID-19 vaccination, the more confident they were in COVID-19 vaccination. Conversely, the more people perceived barriers to getting the COVID-19 vaccine, the less likely they were to be confident in vaccination.

To examine the interaction effects between perceptions related to the COVID-19 vaccine and narrative type on COVID-19 vaccine confidence, an additional hierarchical regression analysis with five interaction terms (i.e., Narrative type ´ perceived susceptibility, Narrative type ´ perceived severity, Narrative type ´ perceived benefit, Narrative type ´ perceived barrier, Narrative type ´ perceived side effects) was conducted. A significant interaction effect between perceived susceptibility and narrative type on COVID-19 vaccine confidence emerged (b = -.348, p < .001) as shown in Figure 6.18. This means that the more people perceived their own susceptibility, the more they were likely to be confident in COVID-19 vaccination; this association was stronger among people who were exposed to the culturally tailored narrative [treatment] than people who were exposed to generic narrative. In other words, COVID-19 vaccine confidence was most pronounced among individuals exposed to culturally tailored narrative with higher perceived susceptibility; whereas COVID-19 vaccine confidence was lowest among individuals exposed to generic narrative with lower perceived susceptibility.

Table 6.7.
Hierarchical regression analysis examining the relationships between HBM constructs, narrative types, and COVID-19 vaccine confidence

	Model A COVID-19 vaccine confidence (b)	Model B COVID-19 vaccine confidence (b)
Block1: Control variables		
Age	.013	.008
Gender (female = 0, male = 1)	-.019	-.015
Education	.021	.018
Household income	.050	.053*
COVID-19 vaccine (yes = 1, no = 0)	.014	.016
ΔR^2	22%	22%
Block2: HBM constructs		
Perceived susceptibility	.048	.263*
Perceived severity	.056	-.095
Perceived benefit	.594***	.600***
Perceived barrier	-.230***	-.223
Perceived side effects	-.060	-.135
ΔR^2	49.6%	49.6%
Block3: Narrative type		
Culturally tailored (=1) vs. generic (=2)	-.074**	-.092
ΔR^2	.5%	.5%
Block4: Interactions		
Narrative type ´ perceived susceptibility		-.348*
Narrative type ´ perceived severity		.273
Narrative type ´ perceived benefit		-.004
Narrative type ´ perceived barrier		.002
Narrative type ´ perceived side effects		.105
ΔR^2		.3%
Total R^2	72.1%	72.4%

Note. All the coefficients are standardized.
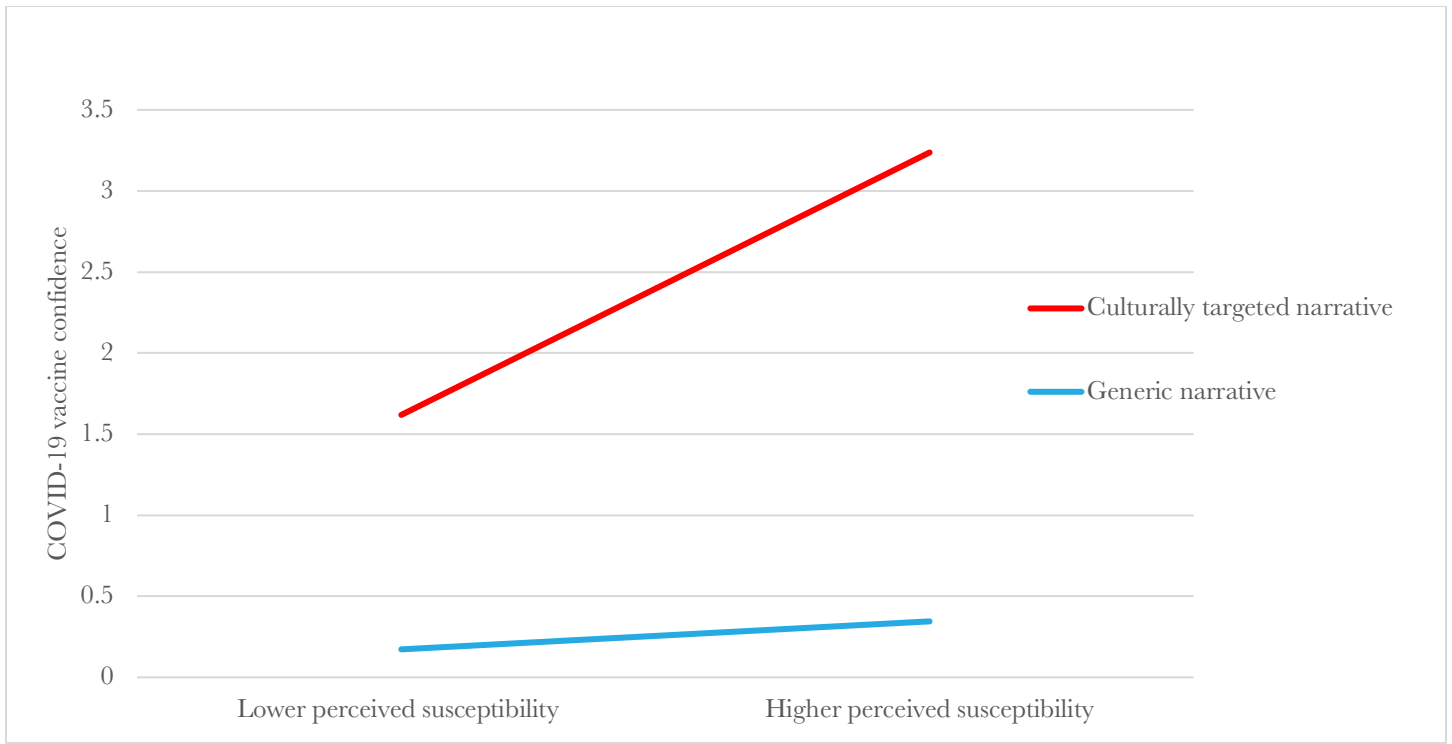*$p < .05$, **$p < .01$, ***$p < .001$.

Figure 6.18. Interaction effect between perceived susceptibility and narrative type on COVID-19 vaccine confidence among Hispanics

CHAPTER 7 | CONCLUSIONS

This study attempted to address the disproportionate impact of COVID-19 among marginalized migrant populations and the lack of research on vaccine confidence among these populations. It sought to trace organic discussions of vaccine confidence within Hispanic communities and use these discussions to develop empirically validated messaging to bolster vaccine confidence and uptake.

The interview findings revealed Hispanics reasons for vaccinating came out of concern for the collective well-being of their communities. There was also a desire to return to normal social gatherings as motivation for vaccination. Trusted sources were doctors, nurses, and healthcare professionals they had access to in their community. Local radio and television shows were more trusted than social media and the internet more generally. Disinformation was seen as prolific and problematic concerning vaccines and the COVID-19 virus (e.g., the virus as manufactured, vaccines containing microchips). Several important access barriers impact the ability of Hispanic migrants to get accurate health information (i.e., access to doctors, general fear of authorities and information collection, linguistically accessible health information). Skepticism about the vaccine and its long-term effects were often mentioned as dissuasive, while first-hand witnessing serious illness from the virus was a strong motivator to get vaccinated.

On social media, Hispanics express confidence in the vaccine by describing how it protects them, stating confidence in the institutions that certify vaccines as safe, the minimization of illness if infected, and the overall responsibility to their neighbors and community. Trusting science, trusting healthcare professionals and pointing out the deadly impact of the virus also resonated. Community members were also quite keen on assisting one another in locating others attempting to find access to the vaccine. Entire groups were formed for the sole purpose of sharing site locations for where vaccines were being administered with one another. Overall, a concern for family and one another came through in the comments.

Quantitative data showed that social media group page narratives are often driven by a top percent of frequent users, often feature religious elements (e.g., Thanking God, trusting God, etc.), the expense of the vaccine, and are information seeking. The sentiment varied from negative to neutral between groups that took negative stances toward the vaccines and those groups that were attempting to put out information for those seeking vaccination. Joy, interestingly, was the most expressed emotion; perhaps indicative of the frequent thanking and praise of one another throughout the data.

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The survey findings showed Hispanic participants favor social media pages that have Hispanic models and use the Spanish language over their non-Hispanic counterparts. Non-Hispanics had very low favorability of Spanish language and Spanish model groups but did show high favorability for English language and Hispanic model groups, as well as English language and non-Hispanic model groups. Adaptations of common themes in the interview findings and social media posts by Hispanics as persuasive message treatments had mixed results. Eight of the ten adaptations performed as well as, or better than generic messaging concerning COVID-19 vaccination. Particularly persuasive were messages that mentioned reducing risk, employee required vaccination, vaccines providing protection, returning to normal, and describing the effectiveness of the vaccine.

Most importantly the survey validated that Hispanic participants who were randomly assigned to the culturally specific narratives were more likely to be confident in the COVID-19 -19 vaccine. Further, COVID-19 vaccine confidence was highest among individuals exposed to a culturally specific narrative with higher perceived susceptibility to the virus; whereas COVID-19 vaccine confidence was lowest among individuals exposed to a generic narrative with lower perceived susceptibility.

These findings demonstrate the importance of narrative theory when crafting persuasive messages and validate that culturally specific narratives and imagery are more persuasive. Thus, an important consideration in communicating to vulnerable migrant populations is allowing them to see and hear representations of themselves in the messaging. Of note, this is not merely adopting the symbolic aspects of culture and layering them into messaging, rather it is an amplification of organic community narratives with culturally specific nuances. While preference is given for images that look like self, the persuasive narratives accentuated Hispanic cultural themes of collectivism and community concern. The study shows those at high risk, and thus perhaps more likely to be seeking out information concerning the vaccine, responded most favorably to culturally specific narratives. This shows the significant impact culturally tailored messaging can have in increasing confidence in the vaccine to those seeking information in Hispanic communities.

Community Outreach

The authors believe several of the findings of this study are empowering for Hispanic community members, particularly that elevating messages promoting the vaccine and helping locate, curate and share accurate information about the vaccine in Spanish would be of immense value to the community in respect to vaccine confidence. That individuals can elevate science and share location information on getting the vaccine that will impact those seeking information online is powerful. The authors plan to disseminate the findings in conjunction with the Hispanic Club at Oklahoma State University. The open-source social media data has also been shared with

researchers at the Institute for Global Health Sciences with the University of California San Francisco.

Dissemination Plans

One research paper based on this report has been accepted for presentation at the International Communication Association (ICA) Health Communication Division in May 2022. Two additional papers are to be submitted to the National Communication Association (NCA) for presentation in November 2022. The project video based on this work is in production, and it will be available at https://mesagroup.okstate.edu/. The authors plan to publish the findings in a series of academic journals.

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APPENDIX A | INTERVIEW INSTRUMENT

1. What are your overall thoughts about vaccination for COVID-19?
    a. How effective do you think the COVID-19 vaccination is?
    [Purpose of questions is to begin general discussion on the topic and obtain a general sense of how the person might respond to more specific questions later on]

2. Have you heard anything positive or negative about the vaccination process?
    a. Any specific stories or examples that you can recall?
    b. Can you recall the sources from where you heard this information about the vaccine?
    [Purpose of questions is to extract narrative examples related to general understandings of vaccination, as well as trace sources]

3. Do you believe the people in your social network are generally in favor or against being vaccinated?
    a. Are there any particular stories or examples used in community discussions that promote the vaccine or vaccine safety that you find useful or helpful?
    b. What are the biggest concerns your community members mention when discussing COVID-19 vaccination?
    c. Is there any claim among your community members about COVID-19 vaccination that you are most concerned with?
    d. Who are the most vocal community members that discuss COVID-19 vaccination?
    i. Do these discussions happen on social media, in person, or at community events?
    [Purpose of questions is to examine community discussions and sources for COVID-19 vaccination information]

4. Who are the primary members within your community that advocate for trusting the COVID-19 vaccination?
    a. Can you elaborate on any particular stories or arguments made by those individuals as to why the COVID-19 vaccines can be trusted?
    [Purpose of question is to examine vaccine confidence narratives from community members, as well as trace sources]

5. Who are the primary members within your community that advocate against COVID-19 vaccination?
    a. Can you elaborate on any particular stories or arguments made by those individuals as to why the COVID-19 vaccines cannot be trusted?
    [Purpose of question is to examine vaccine confidence narratives from community members, as well as trace sources]

6. Has your opinion on the COVID-19 vaccine, or opinions within your community, changed over time?
    a. To what do you attribute the changes, or lack thereof?
    [Purpose of question is to examine opinion change on vaccine and the underlying catalysts]

7. What types of information about COVID-19 vaccinations have you been exposed to on social media?
    a. Have you seen social media advertisements or messages promoting vaccination?
    b. Are you able to identify where social media messages on vaccination come from when you are exposed to them?
    c. Does knowing where messages come from on social media impact your belief or disbelief in the message?
    [Purpose of questions is to examine exposure to public health information as well as misinformation, while trying to discern trust in social media as an information source on vaccination]

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8.   In your opinion, how much do members of your community rely on social media to get information on COVID-19 and the available COVID-19 vaccines?
     a.   Did you find any particular stories or arguments on social media to be impactful on your opinion toward COVID-19 and the available vaccines?
     [Purpose of questions is to examine impactful social media narratives]

9.   From your experiences, in what ways have public health services (i.e., CDC) reached out to the Hispanic migrant community concerning COVID-19 and COVID-19 vaccination.
     a.   Have you found any of the messages from public health services to be particularly persuasive when discussing the risks of COVID-19, or the safety of COVID-19 vaccines?
     b.   Have you found any of the messages from public health services to be particularly confusing or troublesome when discussing the risks of COVID-19, or that of the safety of COVID-19 vaccines?
     [Purpose of questions is to examine reach, receptivity, and trust in public health messages]

10. Are there any obstacles or barriers that you perceive as limiting the effectiveness of messages from public health services to your community in relation to COVID-19 and the available vaccines?
     [Purpose of questions is to examine perceptions of public health barriers that might help justify vaccine reluctance]

11. What do you find to be the most compelling arguments for having confidence that the vaccines for COVID-19 are both safe and effective?
     [Purpose of question is to examine vaccine confidence narratives from individual vantage]

APPENDIX B | SURVEY INSTRUMENT

Survey Participant Recruitment

Title: COVID-19 Vaccine Study

Description: This survey asks questions concerning confidence in the COVID-19 vaccine among Hispanics in the United States. The survey takes approximately 20 minutes. The study is funded by the Vaccine Confidence Fund as part of the Alliance for Advancing Public Health Online.

Keywords: COVID-19, vaccine, confidence, hesitancy, narrative, Hispanic, survey, social media

Survey Link Instructions

We are conducting an academic survey about COVID-19 vaccine confidence. We need to understand your opinion on the persuasiveness of COVID-19 vaccine messages. To be eligible for the survey, you must be of Hispanic ethnicity, currently live in the United States of America, be at least 18 years old, and have an active social media account.

Select the link below to complete the survey. At the end of the survey, you will receive a code to paste into the box below to receive credit for taking our survey.

Make sure to leave this window open as you complete the survey. When you are finished, you will return to this page to paste the code into the box.

Consent

The study you are taking part in is funded by the Vaccine Confidence Fund as part of the Alliance for Advancing Public Health Online. The goal of the study is to collect insights and perspectives on vaccine confidence among Hispanic migrants to the US from Central America and Mexico. Your participation in this study will involve answering a series of questions about vaccination and US public health institutions; specifically discussing COVID-19 vaccines and the narratives used to justify decisions to get vaccinated within your community. The survey questions attempt to better understand what particular narratives and stories on COVID-19 vaccination resonate most strongly among the Hispanic migrant community in the US.

No personal identifying information will be recorded or linked to any of the answers you provide. The research team will work to ensure confidentiality to the degree permitted by technology. It is possible, although unlikely, that unauthorized individuals could gain access to your responses because you are responding online. However, your participation in this online survey involves risks similar to a person's everyday use of the internet. If you have concerns, you should consult the survey provider privacy policy. While there are no risks of participation in this study, and none of the information provided to us will be used against you in any way, you may refuse to answer any of the questions and stop the survey at any time. All responses to the survey questions will be encrypted and stored on a password protected cloud server that only the researchers have access to. The survey process will take roughly 20 minutes of your time.

Your participation will not assist with, nor detract from, any past, current, or future, legal proceedings with the US Federal Government in regard to requests for asylum or any other matter. However, your responses are important toward creating trust in public health among community members. Data derived from survey questions

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will be given over to the Vaccine Confidence Fund for further use and integration in other datasets; including, but not limited to, Creative Commons (https://creativecommons.org/). If you have any questions or concerns about the research, you may contact Dr. Skye Cooley (the principal investigator of this study).

HIT Information
In order to get credit for this HIT, you must read all the questions fully and **answer honestly**. There will be attention questions to validate your participation. If you fail to answer these questions correctly, HIT will be rejected. You may only complete this HIT once. If you complete this HIT multiple times, you will be rejected. The Requester has placed a time requirement on this HIT. Completing the HIT in too little time or taking hours to complete will indicate that you have not completed the HIT thoroughly or thoughtfully, or that you have taken a break during completion, and your HIT will be rejected. Once you start the HIT, please eliminate distractions and do not plan to take a break while participating. The task involves reading. The requester has created their time limits based on average reading speed and number of words involved in their stimuli. If you do not follow these guidelines while completing the HIT, you will be rejected.

At the end of the survey, you will receive a random number generated by the survey service provider, please add the number to the place provided in the survey before hitting submit. This unique ID is different for each participant. The data will be matched with the unique ID provided. If your number does not exist in the data, your HIT will be rejected.

Screening Questions

Q. Age. What is your age? ___

Q0.1. Are you 18-year-old or older?
        Yes
        No -> Redirect to "Not Qualified Message"

Q0.2. Ethnicity (select all applied)
        White/Caucasian
        African American or Black
        Hispanic-> Redirect to "Not Qualified Message"?
        Asian
        Native American
        Other

COVID-19 vaccine uptake
Q0.3. Have you received COVID-19 vaccine shot?
        Yes, first dose and second dose, as well as a booster (4)
        Yes, first dose and second dose (3)
        Yes, only first dose (2)
        No, I have not been vaccinated (1)

Part 2

Below is a test version of several help groups pages on Facebook. The purpose of these Facebook pages is to help you schedule the COVID-19 vaccine. Please assume that you need some help related to the COVID-19 vaccine, no matter whether you have already received the COVID-19 vaccine or not.

Q2.1. Look at all eight images of the Facebook groups. Then, determine which is the preferred (vs. unwanted) place for you to learn more about information regarding the COVID-19 vaccine.

Q2.2. Look at all eight images of the Facebook groups. Indicate your preference for each group you would like to get some help from (1 = Prefer the least, 8 = Prefer the most;)

[Insert Images Below; Randomize Ordering if Possible]

Part1

Please answer the following questions on your social media usage, frequency and purpose.

Usage
Q1.1 Which of the following social media platforms do you have an account with?
    Facebook, Instagram, snapchat, WeChat, Twitter, LinkedIn, other

Q1.5. On an average day, how much time do you spend on the following social media platforms (Facebook, Instagram, snapchat, WeChat, Twitter, LinkedIn, other)
    Do not use
    Less than 30 minutes
    About an hour
    One to two hours
    Three to four hours
    More than four hours

Q1.6. On a regular day, how many times do you post comments or pictures on your social media accounts?
    Never
    Less than weekly
    Around once a week
    A few times a week
    Around once a day
    Several times a day

Q1.7. On an average day, how much time do you spend on social media?
    Not at all
    Less than 30 minutes
    An hour
    1-2 hours
    3-4 hours
    More than 4 hours

Purpose
Q1.8. Please rate your agreement with the following statements (Strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree)
    I use social media to make friends
    I use social media to stay up on current events

I use social media to find employment
I use social media to connect with family or relatives
I use social media to promote products/services
I use social media as entertainment

PRE-vaccine attitude
Q1.9. Please rate your agreement with the following statements: For yourself, getting the COVID-19 vaccine is:
a)   useful (useless),
b)   valuable (worthless),
c)   important (unimportant),
d)   safe (unsafe),
e)   effective (ineffective),
f)   positive (negative),
g)   pleasant (unpleasant),
h)   desirable (undesirable),
i)   satisfying (unsatisfying)

Misinformation literacy
Q1.10. Please indicate your level of agreement with each of the following statements
Generally, I am able to identify misinformation from real news.
It is very unlikely that a piece of misinformation can mislead me.
I never share information with others that I suspect may be false.
When I clearly identify misinformation, I tend to report it.

Misinformation exposure
Q1.11. Please indicate your level of agreement with each of the following statements
I often see social media posts that contain misleading information about COVID-19 vaccine
I often see intentionally fabricated information about COVID-19 vaccine that has been designed to look like news media content
I often see news and information containing content about COVID-19 vaccine that is misleading
I often hear my friends/family talking about false information about COVID-19 vaccine
I often found people from my work spreading rumor about COVID-19 vaccine
I know people in my communities (e.g., church) discussing misleading information about COVID-19 vaccine

Measures for vaccine hesitancy: 3 C's factors (convenience, confidence, complacency)
Q1.12. Please indicate your level of agreement with each of the following statements:
COVID-19 vaccines are necessary.
COVID-19 vaccines are important.
COVID-19 vaccines are safe.
COVID-19 vaccines are effective.
Getting the COVID-19 vaccines is convenient.
COVID-19 vaccines are affordable.
Overall, I am hesitant about getting the COVID-19 vaccine.
If my doctor recommends the COVID-19 vaccine for me, I would get it.
If my friends told me to get the COVID-19 vaccine, I would get it.
COVID-19 vaccines are trustworthy.

Perceived susceptibility, severity, benefits, barriers, safety

Q1.13. Please indicate your level of agreement with each of the following statements:

It is likely that I will contract COVID-19

I am at risk for getting COVID-19

I believe that COVID-19 is extremely harmful

I believe that contracting COVID-19 causes serious negative consequences

It is hard to understand the difference between each brand that the COVID-19 vaccine is made from

I worry about the short-term side effects of the COVID-19 vaccine

I worry that the COVID-19 vaccine might have unknown long-term side effects

Motivations

Q1.14. If you have received a COVID-19 vaccine, what was the primary reason you chose to get it?

It was required by my work

It allowed me to go to restaurants, bars, concerts, or other social events

It helped safeguard my own health

It helped safeguard my family and loved ones

I have not received a COVID-19 vaccine

Q1.15. If you have not received a COVID-19 vaccine, what was the primary reason you chose not to get it?

The COVID-19 vaccines are too new for us to understand their long-term health implications

We don't know what is in the COVID-19 vaccines

The COVID-19 vaccines are ineffective

I'm concerned of the side effects of getting the COVID-19 vaccines

COVID-19 is not a serious threat to my health

I don't know where to get a COVID-19 vaccine

My religious beliefs prevent me from getting the COVID-19 vaccines

I have received COVID-19 vaccine

Information related to COVID-19

Q1.16. How much information do you get about COVID-19 from the following sources?

TV

Radio

Newspapers

Search engine (e.g., google)

Social media

Family members

Friends and peers

Healthcare providers (e.g., doctors, nurses, pharmacists)

Government or public health organization (e.g., WHO, CDC)

Q1.17. Please indicate your level of agreement with each of the following statements:

I am informed about the health issues related to COVID-19

I am informed about the costs and benefits of getting a COVID-19 vaccine

I am confident in my ability to weigh the health risks and benefits of getting a COVID-19 vaccine

I can confidently identify misinformation surrounding COVID-19 vaccines

Information seeking

Q1.18. Please indicate your level of agreement with each of the following statements:

I often seek out new information about COVID-19
I want to stay up to date about new developments related to COVID-19
I don't have time to read about COVID-19
I don't care about information regarding COVID-19
I'm tired of hearing about COVID-19

Source Trust regarding COVID-19
Q1.19. Please indicate your level of agreement with each of the following statements:
I trust information I receive from news (e.g., TV, radio, newspapers) news about COVID-19
I trust information I receive from my social media (e.g., Facebook, Twitter) about COVID-19
I trust information I receive from my health professionals (e.g., doctor, nurses, pharmacists) about COVID-19
I trust information I receive from government health officials (e.g., WHO, CDC) about COVID-19
I trust information I receive from my family and friends about COVID-19

Part 3

Q3.1. On the following page, we would like you to read some statements about the COVID-19 vaccine. After you are finished reading the statements, you will be asked to answer questions. Please pay attention to the statements and answer the subsequent questions.

For Hispanic Group: Generic narrative (N2: control) vs culturally tailored narrative (N1: stimulus)

N1: Culture-tailored
"Last year I wasn't sure if I wanted to get vaccinated. I wasn't sure where to get it, and I heard conflicting reports about it. But then, I caught COVID-19 and became very sick. I had a fever of over 100 degrees for two days, lost my sense of smell, and couldn't eat or sleep. Even worse though, I was afraid I'd pass COVID to my two kids; one who was five and the other who was 7. Once I found out, I had to quarantine for 10 days, and I missed two weeks of work. But I didn't know I had it right away, and before I got sick, I went to a community event in my neighborhood. A couple days after I tested positive, two of my neighbors were also sick. Now I kind of wish I would have gotten vaccinated. I feel like I let my family and community down."
-Maria, 35

[insert Hispanic image here]

N2: Generic
"Last year I wasn't sure if I wanted to get vaccinated. I knew where to get it, but I heard conflicting reports about the vaccine. But then, I caught COVID-19 and was in horrible pain. I had a fever of over 100 degrees for two days, lost my sense of smell, and couldn't eat or sleep. Once I found out, I had to quarantine for 10 days, and I couldn't go out. But I didn't know I had it right away, and before I got sick, I still went work. A couple days after I tested positive, two of my co-workers did as well. Now I kind of wish I would have gotten vaccinated. I feel like I let myself down and should have known better."
-Mary, 35

[insert Generic image here]

Q3.1. Which message do you find more persuasive?

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For Non-Hispanic Group: Generic narrative (control) vs Message (M1: stimulus)
N2: Generic:
 "Last year I wasn't sure if I wanted to get vaccinated. I knew where to get it, but I heard conflicting reports about the vaccine. But then, I caught COVID-19 and was in horrible pain. I had a fever of over 100 degrees for two days, lost my sense of smell, and couldn't eat or sleep. Once I found out, I had to quarantine for 10 days, and I couldn't go out. But I didn't know I had it right away, and before I got sick, I still went work. A couple days after I tested positive, two of my co-workers did as well. Now I kind of wish I would have gotten vaccinated. I feel like I let myself down and should have known better."
-Mary, 35

[insert Generic image here; Same as in prior control]

M1 (message form, non-narrative)
Why should you get vaccinated? It's safe and easy with lots of places offering the vaccine. COVID-19 symptoms include fever, loss of smell, and trouble eating or sleeping. If you get sick, you'll have to quarantine for 10 days and will be unable to go out or go to work. It's easy to get your friends and co-workers sick. Don't feel guilty, get vaccinated.

[no image]

Part 4

Q4.1. Next, we would like you to read two different statements to compare the persuasiveness of messages regarding COVID-19 vaccines. Please pay attention to each statement and pick the one that is more persuasive.

Return to normal contrast
       1a. I would get vaccinated or boosted so that I could attend important social events with my family and community members (viz. cultural celebrations; can be specific)
       1b. I would get vaccinated or boosted so that I can travel to destinations I am interested in.

Responsibility contrast
       2a. It is my responsibility to make sure members of my community don't get sick, that is why I would get vaccinated or boosted.
       2b. COVID-19 vaccines are shown to be working well to prevent severe illness, hospitalization, and death, that is why I would get vaccinated or boosted.

Vaccine comparisons
       3a. Even though everyone's body reacts differently, vaccines have a long history of saving lives against tetanus, polio, smallpox, measles, and other diseases. COVID-19 vaccines save lives by helping the body fight the virus, no different from vaccines of the past.
       3b. Even though everyone's body reacts differently, after a COVID-19 vaccine, non-serious side effects, like arm pain or brief tiredness are common and a sign that your body is building protection against COVID-19 illness.

End the pandemic
       4a. Rather than believing in conspiracy theories, I trust the science behind COVID-19 vaccines. I would get the vaccine or booster to do my part to help end this pandemic.

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4b. To help stop the spread of misinformation, I tap into credible sources to help bust myths and learn the facts about COVID-19 vaccines. That is why I would choose to get vaccinated or boosted.

Provide protection/reduce risk

5a. COVID-19 vaccines provide the body protection to help fight the virus and keep symptoms under control. It's not supernatural immunity, but getting vaccinated or boosted, wearing a mask, and washing your hands, are all part of a larger effort to stop the spread.

5b. It is vital people get vaccinated, stay home and test when sick, and adhere to recommended masking in order to reduce the spread of COVID-19.

Responsibility

6a. Getting vaccinated and boosted helps protect my coworkers and community from getting sick and being burdened by the costs and hassles of doctor visits and missing work.

6b. More than 242.4 million people have received at least one dose of a COVID-19 vaccine. Of those, 205.2 million are fully vaccinated. More than 66.4 million people have received a COVID-19 booster. Like others, I should get vaccinated and boosted.

Obligation to vaccinate (work/government)

7a. I would get the COVID-19 vaccine or booster if my employer required it.

7b. I would get the COVID-19 vaccine or booster if there were a federal government mandate to do so.

Personal experience

8a. After seeing my family and friends get sick, be hospitalized, or even die from COVID-19, I would choose to get the COVID-19 vaccine.

8b. I don't want, "I should have gotten vaccinated" to be my last words. That is why I would choose to get the COVID-19 vaccine.

Cultural collectivist

9a. I would get the COVID-19 vaccine or booster if my parents, siblings, or other family members asked me to do so.

9b. Getting vaccinated and boosted is the most powerful protection you can get against COVID-19 and its variants.

Government mistrust

10a. I would get the COVID-19 vaccine or booster if I knew for certain that none of my personal or identifying information would be recorded.

10b. I would get the COVID-19 vaccine or booster if I knew for certain that I only had to show a driver's license or passport to receive it.

Expense

11a. Needing hospitalization for COVID-19 would be very expensive for me and my family, so I would get the COVID-19 vaccine or booster to avoid the costs of hospitalization and damage it would cause to my family's finances.

11b. Hospital stays can be expensive, but COVID-19 vaccines and boosters are free. Help protect yourself from being hospitalized with COVID-19 by getting vaccinated and boosted.

Accessibility-mistrust

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12a. I would get the COVID-19 vaccine or booster if it were available at easily accessible pop-up tents outside of places I shop and work.

12b. I would get the COVID-19 vaccine or booster if it were available and easily accessible at hospitals.

Health professional trust

13a. I would get the COVID-19 vaccine or boosters if doctors, nurses, and other health professionals like me advocate for it.

13b. I would get the COVID-19 vaccine or boosters because health care professionals, like those from Harvard, advocate for it.

Risk/benefit

14a. I would get vaccinated or boosted because the risk of missing work or infecting my family outweighs the costs of side effects from the COVID-19 vaccine.

14b. I would get vaccinated or boosted because it helps protect against severe illness, hospitalization, and death.

Information availability

15a. I would get vaccinated if more scientific information on the COVID-19 vaccine were available to me in my language.

15b. Don't let a fear of needles get in the way of getting needed protection by vaccines. Learn how to manage your concerns; your family and healthcare providers can help provide information.

Belief in science

16a. I would get the COVID-19 vaccine and boosters because I trust science.

16b. The COVID-19 vaccines and boosters have been shown to provide a great deal of protection against serious illness due to COVID-19.

Demographics

Please answer the following questions.

Q5.1. Did you migrate to the US?

    If yes: Q5.1.2 Where did you migrate from?

        Central America
        South America
        Africa
        Asia
        Europe
        Pacific Islands
        Other

Q5.2. Did your parents migrate to the US?

    If yes: Q5.2.2 Where did they migrate from?

        Central America
        South America
        Africa
        Asia
        Europe

Pacific Islands
Other

Q5.3 What is your age?
(number entry)

Q5.4. How do you describe yourself?
Male
Female
Non-binary/third gender
Prefer to self-describe
Prefer not to say

Family
Q5.5. Which best describes your household?
Single
Married/living with partner/spouse
Married/living with partner/spouse AND children
Single/divorced with children
Other

Q5.6. How many children under 18 live with you?
(number entry)

Q5.6. How old is your oldest children's age?
(number entry)

Q5.7. Which best describes your level of education?
Less than high school
Graduate high school or equivalent
Some college, no degree
Associate degree
Bachelor's degree
Post-graduate degree

Q5.8. Which best describes your household income?
Less than $20,999
$30,000-$39,999
$40,000-$49,999
$50,000-$59,999
$60,000-$69,999
$70,000-$79,999
$80,000 or more

Political
Q5.9. Which best characterizes yourself?
Very liberal
Liberal

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Leaning liberal
Moderate
Leaning conservative
Conservative
Very conservative
Other/prefer not to answer

Q5.10. Which of the following best describes your party affiliation?
Republican
Democrat
Independent
Libertarian
No affiliation
Other/prefer not to answer

Q5.11. How active are you in politics?
Not active at all
Somewhat active
Moderately active
Very active
Extremely active
Other/prefer not to answer

Religion
Q5.12. What is your present religion, if any?
Non-religious
Christian: Catholic, protestant, evangelical, Baptist
Jewish
Hindu
Buddhist
Muslim
Mormon
Jehovah's Witness
Daoist
Other/prefer not to answer

Q5.13. How often do you go to religious service?
Weekly
Monthly
Holidays
Never

End of the Survey

Thank you for your time!

Narrative statement category	Culturally specific narrative statements	Generic narrative statements
Return to normal contrast	"I would get vaccinated or boosted so that I could attend important social events with my family and community members (such as Christmas, New Year, birthday, etc.)"	"I would get vaccinated or boosted so that I can travel to destinations I am interested in."
Responsibility contrast	"It is my responsibility to make sure members of my community don't get sick, that is why I would get vaccinated or boosted."	"COVID-19 vaccines are shown to be working well to prevent severe illness, hospitalization, and death, that is why I would get vaccinated or boosted."
Vaccine comparisons	"Even though everyone's body reacts differently, vaccines have a long history of saving lives against tetanus, polio, smallpox, measles, and other diseases. COVID-19 vaccines save lives by helping the body fight the virus, no different from vaccines of the past."	"Even though everyone's body reacts differently, after a COVID-19 vaccine, non-serious side effects, like arm pain or brief tiredness are common and a sign that your body is building protection against COVID-19 illness."
End the pandemic	"Rather than believing in conspiracy theories, I trust the science behind COVID-19 vaccines. I would get the vaccine or booster to do my part to help end this pandemic."	"To help stop the spread of misinformation, I tap into credible sources to help bust myths and learn the facts about COVID-19 vaccines. That is why I would choose to get vaccinated or boosted."
Provide protection/reduce risks	"COVID-19 vaccines provide the body protection to help fight the virus and keep symptoms under control. It's not supernatural immunity, but getting vaccinated or boosted, wearing a mask, and washing your hands, are all part of a larger effort to stop the spread."	"It is vital people get vaccinated, stay home and test when sick, and adhere to recommended masking in order to reduce the spread of COVID-19."
Responsibility	"Getting vaccinated and boosted helps protect my coworkers and community from getting sick and being burdened by	"More than 242.4 million people have received at least one dose of a COVID-19 vaccine. Of those, 205.2 million are fully vaccinated. More than 66.4 million people

	the costs and hassles of doctor visits and missing work."	have received a COVID-19 booster. Like others, I should get vaccinated and boosted."
Obligation to vaccinate (work/government)	"I would get the COVID-19 vaccine or booster if my employer required it."	"I would get the COVID-19 vaccine or booster if there were a federal government mandate to do so."
Personal experience	"After seeing my family and friends get sick, be hospitalized, or even die from COVID-19, I would choose to get the COVID-19 vaccine."	"I don't want, "I should have gotten vaccinated" to be my last words. That is why I would choose to get the COVID-19 vaccine."
Cultural/collectivist	"I would get the COVID-19 vaccine or booster if my parents, siblings or other family members asked me to do so."	"Getting vaccinated and boosted is the most powerful protection you can get against COVID-19 and its variants."
Government mistrust	"I would get the COVID-19 vaccine or booster if I knew for certain that none of my personal or identifying information would be recorded."	"I would get the COVID-19 vaccine or booster if I knew for certain that I only had to show a driver's license or passport to receive it."
Expense	"Needing hospitalization for COVID-19 would be very expensive for me and my family, so I would get the COVID-19 vaccine or booster to avoid the costs of hospitalization and damage it would cause to my family's finances."	"Hospital stays can be expensive, but COVID-19 vaccines and boosters are free. Help protect yourself from being hospitalized with COVID-19 by getting vaccinated and boosted."
Accessibility	"I would get the COVID-19 vaccine or booster if it were available at easily accessible pop-up tents outside of places I shop and work."	"I would get the COVID-19 vaccine or booster if it were available and easily accessible at hospitals."
Health professional trust	"I would get the COVID-19 vaccine or boosters if doctors, nurses, and other health professionals like me advocate for it."	"I would get the COVID-19 vaccine or boosters because health care professionals, like those from Harvard, advocate for it."
Risk/benefit	"I would get vaccinated or boosted because the risk of missing work or	"I would get vaccinated or boosted because it helps protect against severe illness, hospitalization, and death."

infecting my family outweighs the costs of side effects from the COVID-19 vaccine."

| *Information availability* | "I would get vaccinated if more scientific information on the COVID-19 vaccine were available to me in my language." | "Don't let a fear of needles get in the way of getting needed protection by vaccines. Learn how to manage your concerns; your family and healthcare providers can help provide information." |

Figure D.1 Experimental Facebook help group pages

"El año pasado no estaba seguro de si quería vacunarme. No estaba seguro de dónde conseguirlo y escuché informes contradictorios al respecto. Pero luego, me contagié de COVID-19 y me enfermé gravemente. Tuve fiebre de más de 100 grados durante dos días, perdí el sentido del olfato y no podía comer ni dormir. Peor aún, tenía miedo de transmitirles el COVID a mis dos hijos; uno que tenía cinco años y el otro que tenía 7. Una vez que me enteré, tuve que hacer una cuarentena de 10 días y falté dos semanas al trabajo. Pero no sabía que lo tenía de inmediato, y antes de enfermarme fui a un evento comunitario en mi vecindario. Un par de días después de dar positivo, dos de mis vecinos también estaban enfermos. Ahora desearía que me hubiera vacunado. Siento que decepcioné a mi familia y a mi comunidad"

-María, 35

Figure D.2. Culturally tailored narrative (Spanish version)

"Last year I wasn't sure if I wanted to get vaccinated. I wasn't sure where to get it, and I heard conflicting reports about it. But then, I caught Covid-19 and became very sick. I had a fever of over 100 degrees for two days, lost my sense of smell, and couldn't eat or sleep. Even worse though, I was afraid I'd pass Covid to my two kids; one who was five and the other who was 7. Once I found out, I had to quarantine for 10 days and I missed two weeks of work. But I didn't know I had it right away, and before I got sick I went to a community event in my neighborhood. A couple days after I tested positive, two of my neighbors were also sick. Now I kind of wish I would have gotten vaccinated. I feel like I let my family and community down."

-María, 35

Figure D.3. Culturally tailored narrative (English version; not presented in survey)

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"El año pasado no estaba seguro de si quería vacunarme. Sabía dónde conseguirla, pero escuché informes contradictorios sobre la vacuna. Pero luego, me contagié de COVID-19 y tenía un dolor horrible. Tuve fiebre de más de 100 grados durante dos días, perdí el sentido del olfato y no podía comer ni dormir. Una vez que me enteré, tuve que hacer una cuarentena de 10 días y no podía salir. Pero no sabía que lo tenía de inmediato, y antes de enfermarme todavía iba a trabajar. Un par de días después de que di positivo, dos de mis compañeros de trabajo también lo hicieron. Ahora desearía haberme vacunado. Siento que me decepcioné y debería haberlo sabido mejor"

-Mary, 35

Figure D.4. Generic narrative (Spanish version)

"Last year I wasn't sure if I wanted to get vaccinated. I knew where to get it, but I heard conflicting reports about the vaccine. But then, I caught COVID-19 and was in horrible pain. I had a fever of over 100 degrees for two days, lost my sense of smell, and couldn't eat or sleep. Once I found out, I had to quarantine for 10 days and I couldn't go out. But I didn't know I had it right away, and before I got sick I still went work. A couple days after I tested positive, two of my co-workers did as well. Now I kind of wish I would have gotten vaccinated. I feel like I let myself down and should have known better."

- Mary, 35

Figure D.5. Generic narrative (English version; not presented in survey)