

Article

Examining COVID-19 Sources of Information, Vaccine Hesitancy, and Uptake Behaviors Among Diverse Underserved Latinx Communities: A Convergent Parallel Mixed Methods Approach

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Abstract: At 63.7 million, Latinxs constitute the largest racial/ethnic minority in the United States (US). Early during the COVID-19 pandemic, Latinxs were disproportionately impacted and exhibited lower vaccine uptake. Widespread infodemics contributed to confusion, eroded trust, and fostered vaccine hesitancy among this population. This study used a convergent parallel mixed-methods approach to analyze, integrate, and interpret concurrently collected data gathered as part of the Community Engaged Alliance (CEAL) Against COVID-19 Disparities project, initiated by the National Institutes of Health (NIH) in response to the COVID-19 pandemic in the US. Target populations were three underserved Latinx communities of Miami-Dade County (MDC), Florida, during the pandemic's peak. Qualitative findings show six themes and subthemes that integrate with quantitative survey data (N = 451). Themes included a “wait-and-see” approach to vaccine uptake; concerns about infodemics; attitudes about science, education, healthcare providers; and personal sources of information. Our findings highlight cultural significance, trusted sources, and reasons for hesitancy before vaccination decisions as corroborated by quantitative results. However, divergence was found regarding media sources. Consistent with the literature, although participants report concerns about infodemics and media bias, they still rely on media for updates, particularly with established television networks and trusted personalities. The value placed on education throughout the study (quantitative and qualitative) highlights the importance of culturally appropriate educational interventions. Moreover, the complex nature of the impact that media has on health-related information and vaccine uptake in this population underscores the need for media literacy interventions alongside health education.

Keywords: Latinx/o/a; COVID-19 vaccine; vaccine hesitancy; infodemic; health communication; mixed methods



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1. Introduction

1.1. Latinx Populations and COVID-19 Disparities

Latinxs, the largest racial/ethnic minority in the United States at 63.7 million (over 19% of the population) [1], faced disproportionate COVID-19 impacts during the pandemic's early stages. Studies quickly demonstrated that Latinxs were being disproportionately impacted [2–4] and were less likely to receive the vaccine during its rollout [5–7]. Lack of vaccination among Latinos was likely driven by hesitancy fueled by COVID-19 vaccine misinformation, negative perceptions, and fear over safety and efficacy [8,9].

To address these issues, the current study employs a convergent parallel mixed-methods design to analyze, integrate, and interpret the trusted sources of information on COVID-19 and vaccine uptake among Latinxs in focus groups (N = 24) and surveys (N = 451) residing in targeted underserved communities of Miami-Dade County (MDC), Florida, where over 69% of the population is composed of diverse Latinxs [10]. Data for this study come from the national Community Engaged Alliance (CEAL) Against COVID-19 Disparities, initiated by the National Institutes of Health (NIH), in response to the pandemic.

1.2. Overview of COVID-19 Crisis

The rapid emergence of COVID-19 in 2020 presented a global challenge. On March 11, the World Health Organization (WHO, Geneva, Switzerland) declared a pandemic [11] following reports of over 118,000 cases across 114 countries. Two days later [12], after declaring a national emergency, the President of the United States issued a travel ban for non-US citizens traveling from 26 European countries [12].

1.3. Scientific Advancements and Politicization

After exceeding 400,000 deaths by December [12] and disproportionately impacting minorities [13], the Pfizer-BioNTech vaccine received Emergency Use Authorization (EUA) in December [14], followed by the authorized use of Moderna and Janssen vaccines within two months [14]. Notably, this was the fastest vaccine development in FDA history [15]. However, this progress coincided with a contentious US presidential election, politicizing the pandemic [16–18]. This, along with the substantial death toll, exacerbated health disparities, and the rise of social media “infodemics” [11] fueled widespread conspiracy theories, such as the claims that the pharmaceutical industry created COVID-19 to sell drugs and vaccines, that COVID-19 is a Chinese biological weapon [19], or that COVID-19 test sites were actually inserting tracking chips into people’s nasal cavity [8]. As a result, many individuals were left confused and uncertain about which information to trust and which sources to believe. The challenge of navigating this complex and often conflicting information was compounded by the varying credibility of sources. Trusted health authorities, such as the CDC and the WHO, provided scientific information and public health guidelines, but these messages were often contradicted or distorted by misinformation spread through social media, alternative news outlets, and fringe groups. For example, while scientific experts advocated for vaccines based on rigorous clinical trials and real-world data, some political leaders and media personalities sowed doubt, framing the vaccines as unsafe or part of a larger conspiracy. This created a gap in trust, where individuals, especially those from marginalized communities, were left to reconcile conflicting messages, often relying on personal networks, social media, and anecdotal information, rather than established scientific sources [8,20].

1.4. Infodemics and COVID-19 and Vaccine Misinformation Among Latinxs

Infodemics, as defined by the WHO [11], are characterized by an overwhelming amount of information, including false or misleading content, circulating during disease outbreaks in both digital and physical spaces. This information overload can create confusion, promote risky behaviors, undermine trust in health authorities, and weaken public health-response efforts. Infodemics can exacerbate or prolong outbreaks, as communities become uncertain about effective mitigation measures. While increased use of social media and the internet can help address misinformation, it can just as quickly amplify it [21].

Research indicates that 53% of Latinx adults without a college degree and nearly 70% among less acculturated (Spanish-speakers) use social media at least once a week for health-related information and are more susceptible to believing health-related misinformation [22]. While social media is frequently cited as a source of health information, few (<17%) reported having “a lot” of trust in the information obtained from these platforms [22]. Nonetheless, those who do rely on social media for health advice, at least occasionally, are

more likely to have encountered and believed at least one piece of COVID-19 and vaccine misinformation [22].

1.5. *Trusted Sources Beyond Social Media*

Conversely, while social media use is prevalent among Latinx adults, particularly WhatsApp, traditional mass media, such as local and network TV news, remain highly trusted [22,23]. In fact, about 25% of Latinx adults report high levels of trust in health information from the outlets. Notably, 28% of Spanish-dominant adults named Telemundo and Univision as the most trusted news source with the most reliable information [22].

1.6. *Sources of Health Information and Familismo*

Despite the use of various media sources, over 66% of Latinx adults report trust in the US Center for Disease Control and Prevention (CDC), the US Food and Drug Administration (FDA), and local public health officials for health recommendations [22,24]. Furthermore, several studies found that primary care physicians and family members remain Latinx's most trusted sources for health-related information on COVID-19 [8,22,25–27] and other health-related issues [28,29].

These findings highlight the importance of close relationships in Latinx decision-making, reflecting a core cultural value, known as familism (or familismo), that is present in many Latinx studies [30–33]. Familism emphasizes the importance of the family unit, highlighting respect, support, obligation, and the family as a central source. It fosters a sense of responsibility to care for family members and to consider their input in decision-making [34].

1.7. *Community Engaged Alliance (CEAL) Against COVID-19 Disparities*

The present study is part of the Community Engaged Alliance (CEAL, Indianapolis, ID, USA) Against COVID-19 Disparities project, initiated by the National Institutes of Health (NIH, Bethesda, MD, USA) in response to the COVID-19 pandemic in the United States. Team members of the CEAL Project collaborated with institutions and universities possessing established networks within communities most impacted by the pandemic [35]. The project aimed to address misinformation about COVID-19 and its vaccine, educate underserved populations on mitigation strategies, and promote vaccine acceptance and uptake.

In Miami, the Florida CEAL Team coordinated comprehensive qualitative and quantitative survey data-collection efforts using culturally appropriate outreach and recruitment strategies. These methods included providing clear explanations of the study's objectives in Spanish; partnering with respected community leaders; and offering bilingual (English/Spanish) focus groups, consents, and surveys to ensure inclusivity and to mitigate potential stigma associated with language proficiency. This study employs a mixed-methods approach to analyze, integrate, and interpret concurrently collected data gathered during the peak of the COVID-19 pandemic in the United States.

2. **Theoretical Framework**

The current study employs a convergent parallel mixed-methods design informed by two theoretical frameworks: the Diffusion of Innovations Theory (DOI) and the Cultural Competence Framework (CCF).

2.1. *Diffusion of Innovations Theory (DOI)*

The Diffusion of Innovations Theory (DOI) provides a structured lens for understanding how novel ideas and practices are embraced and adopted within a social system over time [36]. Several key constructs of DOI are particularly relevant for understanding COVID-19 vaccine uptake among Latinx communities. First, the characteristics of the innovation—such as perceived benefits, credibility, and clarity—significantly influence adoption and acceptance [36]. Second, communication channels, including the various media platforms and interpersonal networks, play a crucial role in the dissemination and

reception of information [36]. Third, social systems, which encompass influential figures within the community, impact the dissemination and uptake of COVID-19 information. Community leaders and influencers can significantly shape health-related perceptions and behaviors [36]. Finally, the time it takes for information to be adopted varies depending on factors such as education level, language proficiency, and acculturation [36,37]. DOI has been successfully applied to studies on the adoption of various health-related innovations, including health information technology (HealthIT) [38,39], diabetes management interventions [40], and HIV Pre-Exposure Prophylaxis (PrEP) uptake [41].

2.2. Cultural Competence Framework (CCF)

The Cultural Competence Framework (CCF) is utilized to explore how cultural dynamics influence trust and acceptance of COVID-19 and vaccine information among Latinx adults [42]. Two key components of this framework are particularly relevant. First, cultural awareness involves recognizing the cultural diversity within the sample and understanding how it shapes perceptions of COVID-19, vaccines, and trusted sources of information. Second, cultural competence emphasizes the use of effective communication strategies that are sensitive to cultural norms and values, resonating with diverse Latinx communities [42]. By integrating the DOI and CCF, this study aims to achieve a comprehensive understanding of the mixed data on trusted sources of COVID-19 information and vaccine uptake behavior among the diverse Latinx population in MDC.

3. Design

The current study used a convergent parallel mixed-methods design to investigate trusted sources of information on COVID-19 and vaccine uptake among Latinx adults in Miami-Dade County (MDC), Florida. A convergent parallel design allows for the concurrent collection of quantitative and qualitative data, followed by a separate analysis during the initial stages and data integration during the interpretation phase [43]. While new qualitative data were not collected specifically for the current study, authors leveraged qualitative data from a previously published work by the same research team [8]. These qualitative data were collected congruently with the quantitative data for the current study, strengthening the internal validity of the mixed-methods design.

A key strength of the convergent parallel mixed method design lies in the ability to integrate findings. This integration involves examining how the qualitative and quantitative results diverge, converge, or enrich one another, ultimately providing a more holistic understanding of the research question [43]. The quantitative component of the study identified patterns of trust across various media channels, interpersonal sources, and willingness to vaccinate. Conversely, the qualitative component explored the cultural contexts and community dynamics that influence these patterns. This dual approach facilitates a nuanced analysis of how diverse Latinx communities identify and utilize trusted sources of health information to make informed decisions during disease outbreaks.

4. Qualitative Methods

4.1. Recruitment and Sampling

To gain in-depth insights into the cultural and contextual nuances of information sources and attitudes towards COVID-19 and vaccine uptake within the target Latinx communities, three focus groups were conducted (N = 24) [8]. Recruitment began in January 2021 in collaboration with established community-based organizations (CBOs) serving the three target communities in MDC. Each CBO was chosen based on its history of community participatory research with our academic institution and its dedication to serving the targeted Latinx communities.

The target Latinx communities within MDC varied in their demographics. Communities included (i) North MDC, comprising nearly 30% Latinx residents [44,45]; and (ii) Central MDC, encompassing the neighborhoods of Allapattah (over 76% Latinxs being from Dominican origin) and Little Havana, historically Cuban but experiencing diversification

in recent years with immigrants from Mexico, Central America, South America, and the Caribbean. Little Havana boasted a Latinx population of 95% [44,45]. (iii) Finally, South MDC, centered on the farm-working community of Homestead, has a 69% Latinx population with a higher percentage of foreign-born residents (36%) compared to the rest of Florida (20.7%) [46]. All communities highlight the Latinx diversity of the county.

Purposeful sampling, a common technique in qualitative research, was employed to identify and recruit information-rich individuals [47,48]. This method is particularly valuable when resources and time are limited. Participants in all three focus groups were active community members and leaders chosen for their ability to provide diverse perspectives on the COVID-19 vaccine within their respective communities. The focus-group discussions centered on personal, family/friend, and community attitudes and behaviors towards COVID-19 and the newly developed vaccines. Detailed participant criteria and characteristics are provided in Tables 1–3 below.

Table 1. Qualitative: participant demographics (N = 24).

Variable	n	%
Gender		
Female	21	87.5
Language spoken at home		
English	1	4.2
Spanish	23	95.8
Region of birth		
Caribbean	4	16.7
Central America	9	37.5
North America	7	29.2
South America	4	16.7
Race		
Black or African American	1	4.2
White	16	66.7
Prefer not to answer	7	29.2
Household income		
USD 15,000–USD 24,999	3	12.5
USD 25,000–USD 34,999	4	16.7
USD 35,000–USD 49,999	7	29.2
USD 50,000–USD 74,999	8	33.3
USD 100,000 and above	2	8.3
Education		
High school graduate/GED	3	12.5
Associate's/technical degree	6	25.0
Bachelor's degree	12	50.0
Graduate degree	3	12.5
Age in years (M = 45.4, Mdn = 44, SD = 13.2)		
20–29	3	12.5
30–39	6	25.0
40–49	5	20.8
50–59	6	25.0
60–69	4	16.7

Table 2. Qualitative: inclusion criteria.

Criterion	Description
Ethnicity	Identify as Latinx/Hispanic
Age	Adult 18 years and over
Community involvement	Leader and/or active member of a target community
Consent	Agree to a preliminary survey and attend a 90-min Zoom focus group
Language proficiency	Ability to effectively communicate in English or Spanish
Compensation	Able to receive compensation electronically (e.g., Zelle)

Table 3. Qualitative: fictitious names and individual characteristics (N = 24).

Fictitious Name	Education	Age	Gender	Country of Origin	Household Income (USD 1000s)
South Miami-Dade County					
Elena	BA	52	Female	Colombia	15–25
Antonina	BA	58	Female	Mexico	25–35
Maria	MA	41	Female	United States	50–75
Victoria	HS	34	Female	Nicaragua	100 and above
Angela	BA	59	Female	Colombia	50–75
Sofia	AA	60	Female	Colombia	25–35
Rosa	HS	48	Female	Panama	50–75
Diana	AA	63	Female	Nicaragua	15–25
Central Miami-Dade County					
Martina	AA	30	Female	United States	25–35
Mercedes	AA	58	Female	Guatemala	35–50
Gabriela	BA	49	Female	Nicaragua	50–75
Julieta	BA	61	Female	Nicaragua	35–50
Carlos	BA	65	Male	Honduras	15–25
Nina	BA	40	Female	Nicaragua	100 and above
Natalia	BA	55	Female	Nicaragua	25–35
Raul	AA	22	Male	United States	35–50
North Miami-Dade County					
Luis	HS	40	Male	Argentina	50–75
Julieta	HS	39	Female	Cuba	50–75
Barbara	MA	29	Female	United States	50–75
Ana Maria	MA	56	Female	Cuba	35–50
Rebeca	BA	38	Female	Cuba	35–50
Teresa	AA	20	Female	United States	50–75
Carmen	BA	37	Female	Dominican Republic	35–50
Cecilia	BA	38	Female	United States	35–50

4.2. Data Collection

This study builds upon previously published qualitative findings by the same authors. The published findings were on COVID-19 vaccination hesitancy and acceptance within three underserved Latinx communities in MDC [8]. The current study leverages insights from the published research to contextualize and enrich the quantitative survey data collected concurrently. Therefore, a summary of the key findings is given. The focus here is on how these established qualitative themes resonate with and illuminate the quantitative findings, particularly regarding information sources and vaccine uptake behaviors. Readers interested in a more detailed exploration of the qualitative aspects can refer to the original publication [8].

Prior to each focus group, participants completed a brief demographic survey. To accommodate participants, all focus groups were conducted virtually via Zoom on separate days designated for each of the three MDC communities. Sessions were primarily conducted in Spanish and audio-visually recorded for analysis. Each 90-min group discussion was led by a facilitator, with the support of a co-facilitator. Facilitators ensured clear communication by rephrasing questions or presenting them from different perspectives when necessary, following the best practices outlined by Kruger and Casey (2009).

A single and collaboratively developed focus-group guide was created at our site, taking into account the aims of the national CEAL project. The guide was used across all groups and included open-ended questions, such as “What have you heard or read about the [COVID-19] vaccine?” and “Where do you get information on COVID-19?” To ensure participant anonymity, the pseudonyms assigned during the initial qualitative data collection [8] were maintained throughout this study.

4.3. Data Analysis

Following a line-by-line analysis approach [49], the primary and secondary authors independently reviewed and transcribed the Spanish audio–video recordings from the Zoom focus groups. This minimized additional interpretation layers. To safeguard anonymity, fictitious names were assigned to participants. Transcripts were then collaboratively analyzed to identify major themes and subthemes. Translations into English were performed solely for reporting purposes, and the Spanish transcripts served as the primary data source.

To ensure methodological rigor, a transcript-based thematic analysis was employed [49]. The first two authors, who participated in all focus groups, independently reviewed and coded transcripts from each community. This initial coding was followed by four rounds of collaborative review, referencing the original recordings and field notes to ensure accuracy. Any discrepancies arising during analysis prompted additional review by supplementary authors to strengthen reliability, validity, and achieve consensus.

5. Qualitative Results

The current results explore how qualitative themes, previously identified [8], illuminate the quantitative findings from the surveys collected concurrently. The established themes offered valuable context for understanding the quantitative results regarding information sources and vaccine uptake behaviors.

5.1. Theme 1: Attitudes Regarding Vaccine Hesitancy and Uptake

Focus-group discussions revealed a spectrum of attitudes towards the COVID-19 vaccine, highlighting that “hesitancy and acceptance are not mutually exclusive” [8], since participants often reflected both sentiments.

Many participants expressed concerns about the vaccine, citing similar reasons for their hesitancy, but also citing comparable exceptions. This highlights a more nuanced decision-making process rather than a clear-cut “yes” or “no” stance. Furthermore, all groups included at least one participant who readily embraced vaccination when available, citing similar justifications for their trust. Conversely, all groups also included at least one participant who remained firmly opposed to vaccination under any conditions. These findings underscore the diversity of perspectives within Latinx communities regarding COVID-19 vaccine acceptance.

5.1.1. Subtheme 1.1: “Wait-and-See” Approach

The most prevalent theme associated with vaccine hesitancy (cited 32 times) was a “wait-and-see” approach. This hesitancy stemmed primarily from concerns about the rapid development of the COVID-19 vaccines. Participants expressed anxieties about the speed of vaccine development, as exemplified by the following quotes:

“...when checking the Internet, in previous years, how long does it take for a vaccine to hit the market? Often, two, three, even four, or five years, and this one [was done] in a matter of months... when ‘they’ (scientists) still don’t even understand well what Coronavirus is.”

(Carmen, NMDC)

Concerns about potential short- or long-term side effects further fueled the “wait-and-see” approach among some participants, as exemplified by the following excerpts:

“I think it’s best to maintain good health and wait ... to see what’s going to happen to those people with horrible side effects.”

(Amelia, Central MDC)

“If it [the vaccine] affects other organs, it may protect you, but it’s affecting something else. So, I think we have to wait a little longer to see what the effects of the vaccine are.”

(South MDC)

5.1.2. Subtheme 1.2: The Exceptions

While the “wait-and-see” approach was prominent, some participants identified exceptions. For instance, one hesitant participant, who shifted her position after learning the vaccine might be required for travel, stated she would get vaccinated “at a moment’s notice” to visit her loved ones overseas. Similarly, another participant from Central America within the same group echoed the sentiment by stating, “If for international travel the vaccine is mandated, then I will get it immediately to visit my family,” indicating a subtheme of vaccine hesitancy potentially overridden by the desire to see loved ones (international travel), which may be particularly relevant to Latinxs or immigrants and warrant further consideration.

5.2. Theme 2: Infodemics and Sources of Information

Infodemics and sources of information emerged as significant intertwined themes in participants’ narratives. The overwhelming and often seemingly contradictory information disseminated by the media appeared to exacerbate hesitancy and mistrust in both the development of the vaccine and its developers. Participants consistently emphasized the importance of trustworthy source when making decisions about COVID-19 exposure, mitigation practices, and vaccination.

“... I believe that we have a cocktail of information, lots of very bad information. Things are said without proof or verification... creating fear in society.”

(Nina, Central MDC)

When asked, “What comes to mind when you listen to COVID-19 news, read about COVID-19 (online, newspapers), or talk about it to your friends and family?” Ana Maria, a Central MDC participant noted, “Listening to contradictory things.” She elaborated with the following:

“My personal opinion is that health, in this country, is a business; that is how I see it. It is all about profit and COVID is all about inducing panic. So, when I say all those “things,” I mean all the irrelevant and redundant comments that people bring up that lead to panic, or denial. I say that management of COVID information has been very poor. I have had multiple negative experiences.”

While infodemics fueled confusion and hesitancy, participants still relied on media for COVID-19 updates. Notably, these sources included media personalities (e.g., television hosts) and established television networks like CNN, FOX News, and local/Spanish language broadcasters. For those who frequented online sources, YouTube was regularly mentioned. Angela from Central MDC, for example, cited specific YouTube channels hosted by medical professionals:

“... I have membership in various channels, and in a YouTube channel, there is a host called Gary Burg who is a medical doctor and also very young, he is fabulous because he explains all illnesses very detailed... I also watch Dr. Hyman who has a clinic in New York... [and] there are lots of good medical doctors on television that present programs that help with health that are free and these are the programs that I follow and help me in making my health decisions.”

(Angela, Central MDC)

5.2.1. Subtheme 2.1: Science

Vaccine hesitancy was common even among participants who expressed support of science and showed signs of education. Vicotria was one such participant that complained by saying the following:

“The problem is, they first said it was an unknown virus... then suddenly they make a vaccine. How can they make a vaccine for a virus they don’t know? ... I will not be convinced.”

In response, one participant, Maria (South MDC), added, “When she (Victoria) travels, then she’ll have to take it,” but Victoria replied with, “Not even, I’m willing to not travel. . . .”

When asked, when would be “the right moment to get the vaccine,” Maria responded with the following statement:

“When scientists produce a medical journal that says: ‘People who were vaccinated have become immunologically protected, they are now immune to the virus’; because I want to know, who are these people participating in vaccine trials? Is it a Puerto Rican, a Colombian? A US born Colombian or a foreign-born Colombian? A Puerto Rican like myself? born there. . . or here? You know what I mean? So. . . when I hear that they did trials with a group like me, then I’ll get it (vaccine).”

5.2.2. Subtheme 2.2: Personal Sources of Information

While hesitancy and mistrust were prominent themes, it is noteworthy that over one-third of participants expressed a conditional willingness to be vaccinated. These conditions included requirements for travel or work, or a desire for additional time to assess potential side effects. Interestingly, one participant deviated from the hesitancy sentiment, expressing satisfaction with her own vaccine intake in mid-January 2021, a time when most of the US population remained unvaccinated. Her quote illustrates a contrasting perspective:

“... I called my primary physician. I also have several other specialists—since I have a chronic health condition that requires frequent medical visits—and my physician told me that his practice was recommending intake of the vaccine. I went ahead and got it. A day later, I heard my daughter say, ‘the person I most wanted to get vaccinated was my mother, and she already got it.’ When I heard her say this, I felt so much better. I already have my appointment for my second shot.”

(South MDC)

The participant’s statement exemplifies several key constructs within the COI and CCF theoretical framework. The constructs include trust in her physicians as a source of information; the importance of credible sources of information; evaluation of the vaccine’s benefits in relation to her own chronic health condition underscores the role of perceived risk in the context of individual circumstances; and, finally, familism.

Comments indicating family and relatives as highly trusted sources of information were prevalent across all focus-group participants. Those who reported being vaccinated or intending to be vaccinated often cited recommendations from their physicians, children, or close relatives in healthcare professions. Notably, adult children exerted the greatest influence on vaccination decisions, followed by physicians. Moreover, relationships such as mother/daughter dyads played crucial roles, especially concerning parental health. The recurring mention of children or close relatives in healthcare fields was consistent across all community focus groups, underscoring their significant influence.

5.3. Theme 3: Education

Participants expressed strong sentiments regarding education, frequently using phrases such as “getting educated” during focus-group discussions. Several statements highlighted the sentiments, especially when referring to following CDC recommended mitigation practices.

“I want to share with the group that above everything else there is education [Pause]. I think that the community needs to be educated on a daily basis and addressed with a great deal of sensibility. I believe that first we need education to make people aware that despite whatever our needs, we should not be out shopping without protection, especially those with COVID symptoms should not go to public spaces without being tested first, that, when necessary, they follow mitigation practices.”

(Angela, South MDC)

Alicia from North MDC said the following:

“People need to read, share information, search databases, so they become more educated”
Susana concurred: “Studying is important, community leaders should educate the community and provide information.”

6. Quantitative Methods

6.1. Recruitment and Sampling

In parallel to the qualitative data collection, quantitative surveys were administered to residents of the same three underserved Latinx communities in Miami-Dade County (MDC), Florida, as part of the CEAL project. The Miami CEAL Team ensured cultural appropriateness and study validity by mirroring the outreach and recruitment methods used in the qualitative phase. These methods included providing clear explanations of the study goals in Spanish, partnering with trusted community leaders, and offering bilingual (English/Spanish) consents and surveys to ensure inclusivity and to mitigate potential stigma associated with language proficiency. All participants were given sufficient time to review the consent forms before deciding on study participation (see Table 4 below for inclusion criteria).

Table 4. Quantitative: Inclusion criteria.

Criterion	Description
Ethnicity	Identifies as Latinx/Hispanic
Age	Adult 18 years and over
Community involvement	Member of a target community
Consent	Agree and able to complete survey via REDCap
Language proficiency	Ability to effectively read and understand English or Spanish
Compensation	Able to receive compensation electronically (e.g., Zelle)

6.2. Data Collection

Assessments (surveys) were conducted between April 2021 and February 2023 using a non-concurrent approach wherein data are collected at different points in time from different participants within the same target populations or communities. This approach is useful for observing changes over time within the same population but with different individuals. Upon recruitment and consent of participants, individuals received electronic links via text or email, leading to three distinct Research Electronic Data Capture (REDCap) questionnaires: (i) electronic adult consent form, (ii) CEAL surveys, and (iii) compensation form. Each questionnaire was securely maintained separately within REDCap to uphold IRB confidentiality standards.

Assessment data that were collected focused specifically on sociodemographic characteristics, sources of information, and vaccine uptake. Measures included self-reported demographics, social determinants of health, COVID-19 mitigation measures, testing behaviors, vaccine uptake, trusted sources of information, and healthcare access. Data collection for Assessment 1 commenced in June 2021 and concluded in November 2021. Assessment 2 began in February 2023, followed by Assessment 3, which started in April 2023 and concluded in May 2023. Assessment 3 was modified to reflect recent developments in COVID-19 vaccination, including booster shots and child vaccination. Questionnaire items were also refined to better suit our target communities by removing irrelevant variables, such as ethnicity queries, which were already covered by participant criteria.

6.3. Data Analysis

Descriptive statistics were computed to summarize participants’ characteristics. Measures such as sample mean, standard deviation, and range were utilized to describe age, while counts and percentages were employed for other demographic variables and information sources.

Two-sample *t*-tests were conducted to analyze differences in age across various information sources. Associations between US birth status and each information source were

assessed using Chi-square tests. Additionally, the relationship between COVID-19 vaccine uptake status and demographic variables was examined using two-sample *t*-tests for age and Chi-square or Fisher's exact tests for categorical variables.

Subsequently, multiple logistic regression was performed to assess predictors of COVID-19 vaccine uptake status, incorporating variables that showed significant associations from exploratory analyses. Given that 33% of surveys were conducted at different time points, the assessment time was controlled for in the model. SAS Enterprise Guide 7.1 (SAS Institute, Cary, NC, USA) was utilized for all statistical analyses, and a significance level of 0.05 was employed.

7. Quantitative Results

7.1. Sociodemographic Characteristics

The analysis comprised data from 451 participants residing in Miami-Dade County (MDC), Florida. Participants had a mean age of 40 years (SD = 14, see Table 5 below). Most participants identified as women (65%), White (78%), and employed (75%), and they possessed a high school education or higher (92%) at the time of assessment. Approximately a quarter of participants were born in the United States, while other countries of birth included Venezuela (29%), Cuba (20%), Colombia (14%), and various other Central or South American countries (37%). More than half of the participants (52%) reported a household income of USD 25,000 or more in 2022.

Table 5. Quantitative: Participant demographics (N = 451).

Variable	Mean (SD)	Min–Max	n Missing
Age in years	39.8 (13.8)	18–83	3
Variable	n	%	n Missing
Gender			6
Man	157	35.3	
Woman	288	64.7	
Race			0
White	353	78.3	
Black	21	4.7	
Other	77	17.1	
Education			13
Less than high school	15	3.4	
Some high school	19	4.3	
High school graduate or GED	108	24.7	
Associates or technical degree	131	29.9	
Bachelor's degree	108	24.7	
Graduate degree	57	13.0	
Household income			52
Less than USD 15,000	85	21.3	
USD 15,000–USD 19,999	53	13.3	
USD 20,000–USD 24,999	54	13.5	
USD 25,000–USD 34,999	60	15.0	
USD 35,000–USD 49,999	56	14.0	
USD 50,000–USD 74,999	41	10.3	
USD 75,000–USD 99,999	26	6.5	
USD 100,000 and above	24	6.0	
Employment status			4
Yes	334	74.7	
No	71	15.9	
Other	42	9.4	
Vaccination status: at least one dose			3
Yes	382	85.3	
No	66	14.7	

Table 5. *Cont.*

Variable	Mean (SD)	Min–Max	<i>n</i> Missing
Born in the US			6
Yes	115	25.8	
No	330	74.2	
Country of birth			1
Venezuela	96	29.2	
Cuba	65	19.8	
Colombia	46	14.0	
Nicaragua	41	12.5	
Mexico	23	7.0	
Honduras	22	6.7	
Dominican Republic	10	3.0	
Argentina	7	2.1	
Costa Rica	6	1.8	
Peru	5	1.5	
Ecuador	3	0.9	
Guatemala	3	0.9	
El Salvador	1	0.3	
Panama	1	0.3	

Note: “*n* Missing” is the number of participants who did not respond to the question, or the response was not valid. The number of missing values of country of birth is 1, meaning that 329 out of the 330 participants who were born outside the US reported their country of birth.

7.2. Sources of Information

The primary trusted sources of information on COVID-19 among participants included doctors or healthcare providers (95%, as seen in Table 6); the US government (83%); and news from radio, TV, online sources, or newspapers (77%). Additionally, 74% of individuals considered coworkers and acquaintances as trustworthy sources of information. Approximately 72% of participants trusted information from local politicians or government officials. Over half of the participants reported trusting information from faith leaders (60%) and contacts on social media (57%).

Table 6. Quantitative: sources of information.

How Much Do You Trust Each of These Sources to Provide Correct Information About COVID-19?		<i>n</i>	%
Your doctor or other healthcare provider (N = 415)	No	22	5.3
	Yes	393	94.7
Your faith leader * (N = 316)	No	126	39.9
	Yes	190	60.1
People you go to work or class with or other people you know (N = 393)	No	102	26.0
	Yes	291	74.0
News on the radio, TV, online, or in newspapers (N = 418)	No	96	23.0
	Yes	322	77.0
Your contacts on social media (N = 407)	No	177	43.5
	Yes	230	56.5
The US government (N = 404)	No	69	17.1
	Yes	335	82.9
Local politicians/government (N = 401)	No	114	28.4
	Yes	287	71.6

Significantly older mean ages were observed among individuals who reported trusting information from faith leaders ($p = 0.01$), news sources ($p = 0.02$), contacts on social media ($p < 0.001$), and the US government ($p = 0.03$) compared to those who did not trust these

sources (see Table 7). US-born status was associated with trust in news sources ($p < 0.001$, see Table 8), contacts on social media ($p < 0.001$), and the US government ($p = 0.01$).

Table 7. Quantitative: Two-sample t -tests of age by each source of information.

Do You Trust Each of These Sources to Provide Correct Information About COVID-19?	Age in Years						
	No			Yes			
	<i>n</i>	Mean Age	SD	<i>n</i>	Mean Age	SD	<i>p</i>
Doctor or other health-care provider	21	40.4	15.5	392	39.9	13.8	0.8695
Faith leader	125	37.8	13.5	189	41.8	14.5	0.0131
People you go to work or class with or other people you know	101	38.0	12.6	290	39.3	14.0	0.4007
Mass media: news on the radio, TV, online, or newspapers	96	36.7	14.0	320	40.6	13.8	0.0152
Your contacts on social media	176	36.4	13.4	229	42.1	13.7	<0.0001
US government	69	36.3	13.7	333	40.3	13.8	0.0276
Local politicians/government	114	38.6	14.0	286	40.4	13.8	0.2442

Note: p -values were from two sample t -tests of age by each information source.

Table 8. Quantitative: Overall and stratified frequency table for sources of information by US-born.

Information Source	Overall		US-Born				<i>p</i>
			Yes		No		
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Your doctor or other healthcare provider			115	25.8	330	74.2	0.6421
Trust	389	94.6	106	95.5	283	94.3	
Not trust at all	22	5.4	5	4.5	17	5.7	
Your faith leader							0.8206
Trust	188	60.1	46	59.0	142	60.4	
Not trust at all	125	39.9	32	41.0	93	39.6	
People you go to work or class with or other people you know							0.4831
Trust	289	74.3	79	71.8	210	75.3	
Not trust at all	100	25.7	31	28.2	69	24.7	
News on the radio, on TV, online, or in newspapers							<0.0001
Trust	318	76.8	68	61.8	250	82.2	
Not trust at all	96	23.2	42	38.2	54	17.8	
Your contacts on social media							<0.0001
Trust	228	56.4	40	36.7	188	63.7	
Not at all	176	43.6	69	63.3	107	36.3	
The US government							0.0131
Trust	334	82.9	82	75.2	252	85.7	
Not at all	69	17.1	27	24.8	42	14.3	
Local government/politicians							0.0791
Trust	286	71.7	69	65.1	217	74.1	
Not at all	113	28.3	37	34.9	76	25.9	

Note: The frequencies in the overall sample differ from those in Table 6 for each information source due to missing values in the US-born variable. The stratified frequencies differ from the column totals due to missing values in each information source. p -values are from Chi-square tests.

7.3. COVID-19 Vaccine Uptake

At the time of assessment, 85% of individuals had received at least one dose of the COVID-19 vaccine. Our exploratory analysis indicated that vaccine uptake was significantly associated with higher educational attainment ($p < 0.001$, see Table 9) and being non-US-born ($p < 0.001$). Notably, the COVID-19 vaccine uptake rate was markedly higher during the second and third assessments compared to the first assessment (94% vs. 68%, $p < 0.001$).

Table 9. Frequency: Overall and by vaccine uptake status.

	Overall		COVID-19 Vaccine Uptake Status				<i>p</i>
			Yes		No		
	Mean	SD	Mean	SD	Mean	SD	
Age	39.7	13.7	40.1	14.0	37.1	12.2	0.0952
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>p</i>
Gender							0.6347
Female	286	64.6	243	64.1	43	67.2	
Male	157	35.4	136	35.9	21	32.8	
Education							0.0004
Less than high school/high school	142	32.6	109	29.1	33	54.1	
Associates or technical degree	130	29.8	115	30.7	15	24.6	
BA degree or above	164	37.6	151	40.3	13	21.3	
Country of birth							0.0009
Venezuela	96	21.7	89	23.5	7	10.9	
Nicaragua	41	9.3	36	9.5	5	7.8	
Mexico	23	5.2	17	4.5	6	9.4	
Cuba	65	14.7	61	16.1	4	6.3	
Colombia	45	10.2	42	11.1	3	4.7	
US	115	26.0	87	23.0	28	43.8	
Other	57	12.9	46	12.2	11	17.2	
Were you born in the US?							0.0004
Yes	115	26.0	87	23.0	28	43.8	
No	328	74.0	292	77.0	36	56.3	
CEAL							<0.0001
Assessment 1	150	33.5	102	26.7	48	72.7	
Assessment 2 and 3	298	66.5	280	73.3	18	27.3	

Note: *p*-values are from two-sample *t*-tests for age, Fisher's exact test for country of birth, and Chi-square tests for the rest variables.

Logistic regression results revealed that US birth was associated with decreased odds of COVID-19 vaccine uptake (adjusted odds ratio [aOR] = 0.3, 95% CI = [0.2, 0.6], $p < 0.001$, see Table 10), after controlling for other covariates in the model. Furthermore, individuals assessed during the second and third periods had 5.3 times higher odds of vaccine uptake compared to those assessed during the first period (aOR = 5.3, 95% CI = [2.8, 9.9], $p < 0.001$).

Table 10. Multiple logistic regression for COVID-19 vaccine uptake status.

Independent Variables	Adjusted Odds Ratio (aOR)	95% Confidence Interval		<i>p</i>
Education				
Associates or technical degree vs. less than high school or high school	1.7	0.8	3.5	0.6833
BA degree or above vs. less than high school/high school	2.2	1.0	4.7	0.1496
Born in the US:				
Yes vs. no	0.3	0.2	0.6	0.0007
CEAL:				
Assessment 2 and 3 vs. Assessment 1	5.3	2.8	9.9	<0.0001

N = 430: A total of 21 missing data points due to listwise deletion.

8. Qualitative and Quantitative Integration

8.1. Methods

8.1.1. Data Collection

Employing a convergent parallel mixed-methods design, quantitative and qualitative data were collected concurrently from separate but equivalent samples of participants residing in the same three underserved Latinx communities in MDC. The Miami CEAL Team ensured cultural appropriateness by replicating outreach and recruitment methods for both data collection phases, which included providing clear explanations of the study goals in Spanish; partnering with trusted community leaders; and offering bilingual (English/Spanish) consent forms, surveys, and interview guides.

8.1.2. Data Analysis

Following independent data collection, qualitative data were analyzed thematically using a constant comparative approach to identify recurring themes and patterns in participants' experiences, attitudes, and information sources regarding vaccination [49]. These findings were subsequently published in a separate manuscript [8]. Quantitative data were analyzed separately using appropriate statistical software (SAS Institute, Cary, NC, USA) to identify patterns and trends in vaccine hesitancy and uptake behaviors.

During the integration process, findings from both data sets were used to explore convergence and divergence. We examined how the quantitative results on sources of information, vaccine hesitancy, and uptake rates align or differ with the qualitative themes related to participants' experiences, concerns, and decision-making processes surrounding vaccination.

8.1.3. Results

Table 11, shown below presents the results of this integration, including a list of key findings, areas of convergence/divergence, and potential interpretations for these observations. This integrated analysis aims to provide a more comprehensive understanding of findings from this mixed methods study that focused on the factors influencing vaccine hesitancy and uptake behaviors within the target population.

While integrating the qualitative and quantitative data, a noteworthy finding for this population emerged from the quantitative analysis. US-born participants exhibited significantly lower trust compared to foreign-born participants in traditional media sources (news on radio, on TV, online, or in newspapers) ($p < 0.0001$), social media contacts ($p < 0.0001$), and the federal (US) government ($p = 0.013$). However, nativity (birthplace) was not a demographic variable collected during the focus groups, thus precluding direct integration with qualitative findings.

Table 11. Results of Data Integration.

Qualitative Results (Themes)	Quantitative Result	Convergence/Divergence	Interpretation
“Wait-and-see” approach (Subtheme 1.1)	Vaccine uptake increased significantly over time ($p < 0.0001$).	Convergence	This convergence between the quantitative finding of increased vaccine uptake over time and the qualitative theme of a “wait-and-see” approach suggests that participants in this population may have been following this strategy before making vaccination decisions. Qualitative data indicate that participants expressed a desire for more information or to observe the experiences of others who had already been vaccinated. This aligns with the observed increase in vaccine uptake over time, potentially reflecting a period of information gathering and careful consideration before vaccination, consistent with the reported “wait-and-see” approach.
Concerns about information overload (Theme 2)	Participants (77%) reported trust in news on the radio, on TV, online, or in newspapers, but qualitative data revealed challenges in discerning trustworthy information.	Divergence	This divergence between concerns about media trustworthiness and continued reliance on media sources highlights the complex information environment surrounding vaccines. Qualitative data revealed nuances regarding infodemics that may explain this divergence. The pervasiveness of infodemics likely contributed to hesitancy and confusion, underscoring the need for media literacy interventions, alongside education, for this population.
Trust in science (Subtheme 2.1)	N/A	No Integration	While the concept of “science” was not directly measured in the study surveys, indirect evidence suggests that trust in scientific authority may have played a role in vaccine acceptance. This inference is supported by the findings of overwhelming trust reported by participants in physicians, as well as federal and local government agencies. These institutions are often perceived as relying on scientific evidence to inform their policies and recommendations.
Trust in doctors/healthcare providers (Theme 2.2)	Trust in doctors or other healthcare providers as a source of information was 95% among participants.	Convergence	The convergence between participants’ emphasis on credible sources of information and their reported trust in healthcare providers for COVID-19 information aligns with established findings. The current study reinforces this established pattern, demonstrating that healthcare providers remain a critical source of trusted information for Latinxs, not only for general health concerns but also for emerging public health issues like COVID-19.
Trust in personal sources of information (Subtheme 2.2)	N/A	No integration	Although qualitative data highlight the significance of familism in information seeking, the lack of consistent quantitative data on personal sources of information limits our ability to definitively assess their relative weight compared to other sources. Future research efforts should aim to collect comprehensive data on all relevant sources of information for Latinxs to provide a more holistic understanding of information flow.
Education emphasis (Theme 3)	Higher educational attainment was associated with increased vaccine uptake ($p = 0.0004$).	Convergence	Convergence between the quantitative finding of higher education associated with increased vaccine uptake and the qualitative theme of valuing education suggests a strong emphasis on education and educational resources. This convergence highlights the potential effectiveness of culturally appropriate educational interventions and materials in promoting vaccine acceptance within this population.

9. Discussion

9.1. Conclusions

This study observed a statistically significant increase in vaccine willingness among Latinx participants over a two-year period, suggesting a potential association with increased trust in vaccines. The qualitative findings indicate that participants may have employed a “wait-and-see” approach, informed by factors such as vaccine efficacy data, public health messaging, educational outreach, and shifts in the political climate. These findings align with prior research that highlights how vaccine acceptance can evolve as communities process emerging information and weigh risks and benefits over time [50,51].

While this association is promising, establishing a causal link between time and increased vaccine willingness requires further investigation. Potential mechanisms, including improved efficacy data and culturally appropriate public health campaigns, could account for the observed trend. However, other influences—such as policy changes, vaccine availability, and societal norms—must also be considered. Future studies should control for these confounders to clarify the mechanisms behind changing vaccine attitudes over time.

Consistent with existing the literature [31,52], our findings underscore the importance of informal, culturally tailored communication channels in reaching Latinx communities. Specifically, and consistent with the literature, the reliance on trusted sources, such as family members, community leaders, and culturally relevant media, plays a pivotal role in shaping vaccine attitudes [8,22,25–27,34].

Overall, this study provides a nuanced understanding of vaccine hesitancy and acceptance within Latinx communities, highlighting both consistencies with existing research and unique insights into the evolving role of media and culturally tailored interventions. These findings underscore the critical need for multifaceted, culturally sensitive public health strategies that integrate health education, media literacy, and community-based approaches to improve vaccine uptake and trust in health initiatives.

9.2. Limitations

The current study includes several limitations. Due to the urgent need for data in response to the onset of the COVID-19 outbreak, data collection was completed swiftly. Consequently, the variables collected evolved slightly over time as new information became available and circumstances changed. Therefore, to ensure consistency and comparability across the two data collection points, only variables consistently measured in both quantitative surveys were included in the final analysis. While this approach strengthens the internal validity of the findings, it also limits the scope of the analysis by excluding potentially relevant variables not consistently collected. In addition, purposeful sampling was conducted to target underserved Latinx communities, restricting generalizability of the findings. Finally, while non-concurrent study designs like this one provide insight into temporal trends and changes in attitudes over time, they have limitations in establishing definitive causality due to factors such as temporal sequence and historical bias. Future research employing longitudinal designs can help to strengthen causal inferences.

9.3. Future Research

This study establishes a foundation for future research to build upon the current findings and promote vaccine equity in underserved Latinx communities. Future research could include longitudinal studies that track changes in attitudes and vaccine uptake over time, helping to develop and assess culturally tailored interventions while identifying emerging trends. Additionally, in-depth qualitative studies could explore the underlying motivations for vaccine acceptance among initially hesitant participants.

Furthermore, the findings regarding increased vaccine willingness for travel suggest a potential link between perceived necessity and vaccine acceptance within this population. Research that examines this link could inform policy development by identifying ways to promote vaccination through emphasizing its benefits for specific needs or goals, such as travel.

Finally, broadening the scope of research to include other minority groups can enhance generalizability or illuminate other unique challenges. These future research directions build upon the foundation established by this study to ultimately improve vaccine equity and population health outcomes among underserved communities.

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