Strategies That Promote Equity in COVID-19 Vaccine Uptake for Latinx Communities: a Review

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Abstract

Latinx people in the USA have had a high burden of COVID-19 cases, hospitalizations, and death, yet rates of COVID-19 vaccine uptake among Latinx individuals were lower than other demographic groups. Effective strategies to promote vaccine uptake among Latinx communities are needed. We conducted a rapid review of information available between December 2020 and August 2021. Our search strategy used PUBMED, Google, and print media with a prescribed set of definitions and search terms for two reasons: there were limited peer-reviewed studies during early period of roll-out and real-time perspectives were crucially needed. Analyses included expert opinion, descriptions of project implementation and outcomes. We found that approaches varied. An integral component with all interventions was the use of local Latinx community leaders. They could understand the nuances of vaccine hesitancy, access issues, and structural inequities experienced by Latinx communities. The mechanisms for messaging included the use of social media, radio, and promotora outreach workers to disseminate information about COVID-19 vaccines and counter misinformation. Phone hotlines for scheduling were reported. Promoting access involved pop-up clinics at shopping malls, farmer's markets, and nearby grocery stores which were popularly used to vaccinate Latinx community members. Other practices included limited registration requirements, avoiding online-only communication, and training staff to provide specialized support to Latinx clients. This rapid review provides a basis for developing strategic implementation to increase COVID-19 vaccine uptake in this ongoing pandemic and planning to promote health equity for future bio-events and health crises.

Keywords COVID-19 · Vaccine · Hesitancy · Access · Interventions · Latinx · Hispanic · Community

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Introduction

COVID-19 vaccines are highly effective at preventing infection and reducing the likelihood of severe illness and mortality, yet a considerable number of people in the USA are not fully vaccinated [1, 2]. Latinx people are both at high risk for COVID-19 infection, hospitalization, and death, but during the early roll-out of the vaccines uptake was more than 10% lower in Latinx than their non-Latinx White and Black counterparts. An earlier review found that this inequity of COVID-19 vaccine uptake may be related to a combination of vaccine hesitancy and lack of easy access to the vaccines [3]. That review on vaccine hesitancy among Latinx mentioned the effects of systematic racism including government and medical mistrust expressed as concerns about the safety and side effects of the vaccines. Also prominent in that review were concerns about access to vaccine that included language barriers, affordability, and apprehension



about having to take time off from work to get the vaccine or recover from possible side effects [3].

Interventions that address Latinx community–specific COVID-19 vaccine concerns and access are crucial to boost uptake and protect Latinx people from COVID-19. This review sought to identify strategies and efforts around community outreach and engagement that were made early after introduction of the vaccine. Efforts detailed provide a range of actions that can be implemented and evaluated now. An inventory of structure and activities can then become systematized and codified in preparedness plans for preemptive rapid response early in programmatic roll-out to swiftly achieve the goal of optimal protection for the Latinx communities in current and future bio-events.

Methods

Because this report was being generated within the first 9 months of COVID-19 vaccine rollout, it was likely that this time period was insufficient to report on more than plans and descriptions of programs. The decision was made to conduct a rapid review [4] and to widen the traditional academically oriented search engines to include access to gray literature. A literature search was conducted in July and August 2021, and the following search engines were used: Google (limited to the first five pages) and PubMed.

Search terms included three parts. The first part was "COVID-19 vaccine," The second part was "Hispanic" OR "Latino." The third terms were "community" OR "access" OR "collaboration" OR "outreach." For articles to be included, they must have been published between December 2020 and September 2021, which aligned with the authorization and distribution of COVID-19 vaccines in the USA. Reports needed to be original reports, and not a report of another article. For the purposes of this report, the term Latino/a/x was used except when names of organizations, titles, or tables of reports used Hispanic in which case that terminology was retained.

Inclusion/Exclusion Criteria

Publications were limited to the USA, written in English, and published during and after December 2020. The rationale for the time frame was that reports before this time examined population knowledge, attitudes, and intentions for a hypothetical COVID-19 vaccine, whereas literature available since December 2020 was more likely to have the context of imminent and subsequent availability of a COVID-19 vaccine. Abstracts only were excluded. Media stories or commentaries that were only about content from an otherwise published report without any additional analyses were excluded in favor of the original referenced material.

Data Abstraction

Each primary search term was assigned to an individual team member with a second member replicating the search. Data abstraction included sourcing of data: primary or secondary. Line listings captured the following characteristics: author, title, journal or website (with date accessed), date of publication, literature type (e.g., journal article, newspaper article, etc.). In addition, to address all the outcomes in this review, we created columns with indicators ("1" or "0") for availability of information on equity, interventions, communication strategies, logistics, vaccine hesitancy, and vaccine uptake, respectively. Categories were created to denote the specific group(s) discussed in the article based on race, ethnicity, and immigration status. Study methods were recorded: sample strategy and final size, study design, data collection, and analytic methods. Key findings were recorded. Validation (independently by DV and SAM) for both PubMed and Google searches was performed for select search terms to examine for relevance, significance, and validity for study inclusion.

Analyses and Reporting

Study findings in accordance with the outcomes were reported by (authors) DD, JD, LT, SAM, and DV using narratives and tables. Data were grouped by their outcomes and study populations (i.e., demographic search terms). We include a disclaimer that we are using categories from the survey tools. We conducted a narrative synthesis of the data to identify common findings.

Results

A total of 150 articles found on Google were screened. Of those, 33 were included. Six of the included articles were either recommendations or expert opinion, and the remaining articles were either descriptions of interventions to increase vaccine uptake and evaluations of programs to increase vaccine uptake among Latinx community (albeit evaluations were very rare, given the short time period). A total of 54 papers were found on PubMed. Of these, one was included. Articles were removed from both Google and PubMed primarily because they did not describe or provide information on vaccine interventions specific to Hispanic/ Latinx communities, for example, studies that reported ethnicity as a factor (with no further analysis), studies on hesitancy, news articles that had one line on Latinx communities, government websites that say something along the lines of "click here for Spanish translation", or re-postings of the

same article on different platforms. There were also many irrelevant articles/studies that were not remotely on-topic, but would show up because of certain trigger words.

Table 1 shows an outline of partnership strategies for building trusted communications and access around COVID-19 vaccines among Latinx communities. These include differing levels of participation (i.e., state, country), mechanism for information dissemination (i.e., social media, phone hot-lines, radio campaigns, and outreach workers), and access through pop-up events (e.g., former malls, local grocery stores, work places, mobile clinics, special events). Expert opinion and cases are described below.

Trusted Communication

Expert Opinions on Best Practices for Communication Around Vaccine Promotion

General recommendations by experts describe basic principles and detailed nuances to increase COVID-19 vaccine uptake among Latinx communities. Communication should highlight critical details of the vaccine roll-out process; it must be clear that the vaccine is free, does not require insurance, and the identification requirements for the local area [5, 6]. Alternative options for identification are recommended including no ID required or alternatives (such as NYCID), as many Latinx people may not have state approved identification provided. Also, immigration policies impact many Latinx families - experts recommend the importance of conveying that vaccine status will not have an impact on immigration status or public charge which is essential to encourage vaccinations for concerned Latinx individuals. Moreover, content of messaging should touch on the safety and efficacy of the vaccines [5]. All content should be tested with community members regularly to ensure relevance and clarity [7].

Vaccine promotion must give equal attention to the delivery of these pro-vaccine messages. Consistently and unsurprisingly, experts emphasize the need for Spanish-language materials for Latinx communities [5-7]. This would ideally be sourced by Latinx community members or advocates who can contextualize promotion to the local community, delivering information on vaccination sites, requirements, and other necessary details [5-7]. Communication channels such as radio and social media are recommended dissemination methods [5, 7].

Description of Interventions Used to Promote Vaccine Uptake

The breadth of COVID-19 vaccine misinformation provoked many government officials, healthcare professionals, and community leaders to respond with outreach and educational efforts. These efforts, by and large, have neglected Latinos who speak primarily Spanish, work in shift-work industries, and might not have established trusted health information.

In response to the dearth of Latinx-focused responses, concerned community members and organizational stakeholders created a diverse array of mechanisms to communicate COVID-19 information. All the interventions in this review had a Spanish-language component. One group included Mayan Indigenous languages for Latinx that may have Mayan ancestry as well [8]. Regardless of the language, it is important for the level of Spanish to remain colloquial; translating materials with local Latinx health workers can provide this high degree of translation quality [9, 10].

Furthermore, an integral component with all interventions in this section of the review was the partnership with local Latinx community leaders. They could understand the nuances of vaccine hesitancy and access issues within Latinx communities. Some interventions included widely known persons, such as celebrities, online creators, soccer players, and media personalities [11, 12]. Their followings are easily leveraged for any communication effort.

Physicians were another critical component to many of these interventions, as they are seen as a reliable source of

Table 1 Outline of partnership strategies for building trusted communications and access around COVID-19 vaccines among Latinx communities

Trusted communications		
Levels	State	Government Hispanic Commissions, Chamber of Commerce, Latinx serving or predominantly hiring businesses, Mexican Consultate
	County	Healthcare Organizations, Clinicians serving the community, Community Stakeholders (e.g., Latinx Community Based Organizations), Religious Leaders, Promotor/a (Spanish speaking outreach workers)
Mechanisms	Social media	Facebook; WhatsApp: focused local information
	Radio	Spanish language stations, public service announcements, talk radio
	Hot-lines	Phone for those without internet access; information and offering reserved spots
	Promotor/a	Community outreach; coordinate with health department
Access	Pop-up sites	Malls, nearby grocery stores, mobile clinics, worksite, special events (e.g., music and art installations, sports tournaments)

information [13–17]. Programs that build on bilingual outreach explicitly from physicians through social media have been developed. For example, the Kaiser Family Foundation supported development of *THE CONVERSATION / LA CONVERSACIÓN* to address information needs about the COVID-19 vaccines in the Latinx community with new videos featuring doctors, nurses, and promotoras (community health workers) in English and Spanish [18].

Marketing and Outreach Campaigns

Specific states led their own efforts such as the "Vacunate, Es Segura..." campaign, based on a partnership between the Idaho Commission on Hispanic Affairs, Community Council of Idaho, Consulate of Mexico in Boise, and the Idaho Hispanic Chamber of Commerce [15]. This program provided clear vaccine access information directly into the local context for Latinx communities in Idaho. While the campaign communicated overall COVID-19 vaccine benefits, it also amplified information on accessing the vaccine including appointment bookings. As vaccine hesitancy continues to demotivate community members, other issues regarding vaccine development and requirements for eligibility concern Latinx peoples. The Californian partnership between the Kaiser Family Foundation, UnidosUS, and 10 Latinx health professionals aimed to clarify details on citizenship, health insurance, and vaccine safety through video promotion efforts on social media [16].

In Wisconsin, another Mid-Western state, *Forward Latino* and Latinx physicians united under the "*Por Mi Familia*" campaign to address vaccine hesitancy through a multimedia campaign. Funded with \$50,000, the social media presence was supplemented by television ads and print media. Multiple campaigns with the Colorado state government pulled businesses that largely employ Latinx workers to directly provide educational materials, promote awareness ads, engage with people for testimonials, and connect workers with community workers to ask questions directly [19]. Similar efforts were seen in Kansas under the "*Por Los Nuestros*" vaccine campaign, which included the Kansas Hispanic and Latino American Affairs Commission and the Kansas Department of Health and Environment [12].

Smaller, local-led efforts in Ulster County, NY, illustrated the ways in which small counties can still provide strong outreach [20]. Healthcare providers, community stakeholders, and even religious leaders were united to provide Spanish education on COVID-19 vaccine information and access. Between the multiple agencies, Latinx community members could also access food assistance to address an important need and provide more opportunities to discuss the vaccine. This was an off-shoot to a Spanish-language Facebook Live event that brought a popular Spanish television personality to moderate.

Social Media Campaigns

The objectives of several social media campaigns centered on building trust, promoting vaccine information, and using the Spanish language [9, 11, 14, 15, 17]. Community leaders and healthcare professionals are provided the opportunity to dispel myths with medical facts through trusted channels and to a broad audience. The different slogans for these campaigns include "#VacunateYa" [14], "Vacunate, Es Segura. Es Gratis. Funciona" [15], "Por Mi Familia" [13], "La Conversación" [16], and "Por Los Nuestros" [12].

Local organizations led most of these campaigns. In Georgia, the Latino Community Fund has leveraged testimonials from community educators to invite questions about the vaccine [9]. They profiled Spanish speakers who can share their own hesitancies while also providing evidence that speaks to the benefits of the vaccines. Other campaigns were more targeted — physicians and Latinx-serving organizations in Los Angeles and Orange County launched #VacunateYa to address the need for local vaccine materials in Spanish [14]. In-person distribution of flyers supported the campaign, focusing on farmworkers in the area that may not encounter virtual COVID-19 vaccine promotion. Support for vaccine appointment bookings and eligibility clarification can occur on the spot if organizations invest in physical promotional events that supplement social media promotion. The organizers of #VacunateYa continued to push an additional campaign as a call-out to Facebook and advocated for improved monitoring of misinformation in Spanish. Moreover, while there is no clear connection between the movement and a change in Facebook's priorities, the Center for Disease Control created "Mi Chat Sobre Vacunas COVID," a chat through WhatsApp that allowed users to access information on the vaccine and nearby vaccination sites, transportation options, and answers to common questions [21]. Additionally, in El Paso, Texas, another local effort was able to provide additional resources through the El Paso health department's social media campaign [10]. The Director and 40 other public health officials circulated vaccine information in collaboration with community educators and physicians. They were able to provide additional support for farm workers to explain how to register for appointments and create appointments themselves. Dubbed the COVID-19 Education Task Force, their site engaged more than 15,000 people in April and has been in contact with over 40,000 people.

Indeed, government agencies and public health departments were major influencers in the creation and promotion of some social media campaigns. Yet, sustaining these efforts requires considerable community involvement and ongoing engagement. The joint resourcing was strengthened by greater personnel capacity and communication channel access. For instance, a national campaign between *UnidosUS*, the U.S. Department of Health and Human Services, and several public and private organizations aimed to increase vaccine trust and intention through multilevel educational outreach [11]. Their approach grounded social media as a major tool to promote other COVID-19 educational sessions, including neighborhood canvassing, online events, and distribution of materials. By partnering with local leaders, local and state governments coordinated a multi-state mobile educational tours to engage with Latinx communities. To date, outcomes such as extent of reach and trajectory of vaccine uptake have not been reported.

Radio Stations

Radio stations provide an alternative method to disseminate information among Latinx communities [5, 8, 11, 13]. Spanish radio stations have a reliable base of Latinx, which inspired Florida-based WeCount! to create short public service announcements [8]. These advertisements can be intermittently added to different radio segments throughout the day. They also promoted workshops and organizations that can provide answers to common questions. In Southern Washington, the Benton Franklin Health District invested \$30,000 into a radio campaign that promotes COVID-19 vaccine uptake in Spanish [5]. The planning and promotion of the radio programming included the mayor of Pasco and other trusted Latinx community leaders. They expected that the inclusion of well-trusted persons would improve the credibility and trustworthiness of the information for Latinx community members.

Phone Lines

Online booking has been a barrier for many Latinx people, as most vaccine registrations, details on eligibility, and other communications are primarily sourced on websites. Telephone hotlines are easily accessed through the phone by community members that are challenged with internet access issues or low familiarity with the internet. The state of Colorado created a non-stop hotline specifically for the vaccine where call center workers spoke multiple languages [19]. Moreover, a reverend in St. Paul, Minnesota, worked with WellShare to create its own hotline locally to support vaccination appointment bookings and transportation to vaccination sites [22]. The significance of religious figures is demonstrated through Latinx callers who have faithbased questions on the vaccine and are looking for spiritual support.

The Maricopa County Department of Public Health provided evidence to the success of phone lines to increase vaccine uptake [23]. They added an option to speak to a Spanish-speaking worker in their 2–1-1 COVID-19 information line. Without any advertising, the program had 1,160 calls and 648 vaccine appointments in 10 days. Over half of these calls were specifically used to assist in booking appointments, while the rest allowed Latinx callers to ask questions and gather information on vaccination logistics.

Promotor/Promotora

The promotor/promotora program is well-established in Latinx communities; it refers to community workers being the primary messenger to communicate health information. Anyone can be a promotora, as it is loosely defined by each organization. It commonly describes a Spanish-speaker who is well known in the local Latinx community and can provide accurate, trusted health information. The program has been used to provide accurate COVID-19 vaccine safety information and logistical support in Arizona, Minnesota, Colorado, Maryland, California, North Carolina [19, 22–25]. Key partnerships between Latinx-serving organizations, public health departments, and other government agencies are critical as they combine resources, personnel, and information to strengthen outreach efforts [22, 25].

The use of promotors allowed the penetration of COVID-19 information in ways that virtual efforts cannot influence. For instance, CASA health promotors in the suburbs of Maryland were able to physically communicate with Latinx community members in close by locations, including outdoor churches, malls, and farmer's markets, even while social distancing was enforced [26]. In North Carolina, *La Semilla* used their audience as a faith-based organization in partnership with Duke Health to book 500 first-dose vaccine appointments in 3 hour [25]. They were able to provide food to community members as the organization provided education on individuals' privacy when receiving a vaccine.

Communication Resources

Responding to the health sector's call for support by community agencies, many Latinx-focused organizations created bilingual and culturally relevant resources, videos, toolkits, email templates, event ideas, and lists of support services [24, 27, 28]. These could be used by other government agencies, businesses, public health units, and all other stakeholders.

Access

Recommendations and Expert Opinion

"Pop-up clinics" often refer to non-traditional clinics that have modified locations, time of operation, recruitment strategies, personnel, and other characteristics. Primarily, advocates prioritize the setting of the pop-up clinics and suggest that they should be located near Latinx neighborhoods, workplaces, or common locations that they visit [5, 29]. Indeed, it is suggested that people should not need a car to attend vaccination events. The familiar places provide trust, which is especially important given the concerns on vaccine safety, ICE presence, and immigration refusals [5, 30].

Policies and logistical details of vaccine clinics may also be barriers to vaccine uptake for many Latinx peoples. Pop-up initiatives should be available in the evening and weekends. Other best practices include limited registration requirements, avoiding online-only communication, and training staff to provide extra support to Latinx clients [5, 25]. For instance, some Latinx people may prefer to note their names on paper or read the laptop screens to clarify spelling [25].

Intervention Details

Workplaces, shopping malls, farmer's markets, and nearby grocery stores were popularly used to vaccinate Latinx community members [26, 31, 32]. To attract Latinx workers, processing companies have partnered with health organizations in Washington State [5]. Similar clinics in Washington state were available until the evening and weekends [5]. While in California, grassroots organizations have focused on farmworkers and undocumented immigrants, bringing mobile clinics to the agricultural sites for Latinx staff [33]. The Sacramento Latinx community was able to receive a vaccine at the Consulate of Mexico parking lot [34]. Other stakeholders designed more formal methods that integrated Latinxserving community organizations as liaisons for healthcare centers. Two Maryland counties reserved vaccination slots at a vaccination clinic specifically for CASA and the Latino Health Initiative. Furthermore, a privately and publicly funded vaccine clinic in San Francisco was set up near a major transportation hub, which had a maximum capacity of 120 vaccinations per day [35]. Local organizations conducted outreach and promotion to Latinx communities.

There have been creative elements to pop-up clinics for Latinx that specifically address common concerns or barriers in Latinx communities. In response to the widespread fear of ICE at health spaces, Texan pop-up efforts modified their pop-up event by hiring disguised private security to limit anxieties related to law enforcement [33]. Moreover, recruitment and promotion strategies were particularly innovative. A live music event and a Spanish vaccine-themed art exhibit in California was designed to attract Latinx community members [36]. Unidos leveraged a soccer tournament with food stands to attract people to receive vaccines in Philadelphia, which occurred after regular Sunday church service [30]. Certainly, church services were commonly used as ways to promote vaccines with Latinx communities [37].

Some interventions were able to provide data relevant to vaccine uptake — these interventions centered on a change

in setting to increase access for Latinx communities. For instance, Nassau Woods is a small Georgian community comprised of 300 families where multiple organizations partnered to deliver vaccines in their neighborhood [38]. There were at least 24 first-dose vaccinations that were confirmed at the time of reporting. In Chattanooga, Tennessee, the Hamilton County Health department and a local grocery store, *La Carniceria*, created pop-up vaccine clinic at the store entrance [31]; 33% of the local Latinx community were able to access this initiative, with a total of 45 vaccines administered in 1 day. Additionally, *Novant Health* team stationed at *Compare Foods* grocery stores in Charlotte, North Carolina [32]. They managed to vaccinate 101 Latinx individuals through walk-up visits.

In San Francisco, in the most comprehensive report to date, a community-academic-public health partnership, "Unidos en Salud," implemented a multi-component, "Motivate, Vaccinate, and Activate" community-based strategy addressing barriers to COVID-19 vaccination for the Latinx population (39). To summarize, the prototype outdoor, "neighborhood" vaccination program was located in a central commercial and transport hub in the Mission District in San Francisco during a 16-week period from February 1, 2021, to May 19, 2021. Programmatic data, citywide COVID-19 surveillance data, and a survey conducted between May 2, 2021, and May 19, 2021, among 997 vaccinated clients \geq 16 years old were used in the evaluation. There were 20,792 COVID-19 vaccinations administered at the neighborhood site during the 16-week evaluation period. Among vaccine recipients, 70.5% were Latinx, 76% with an annual household income less than \$50,000, 60% were first-generation immigrants, and 62% did not have access to a primary care provider. The most frequently reported reasons for choosing vaccination at the site were its neighborhood location (28.6%), easy and convenient scheduling (26.9%), and recommendation by someone they trusted (18.1%); approximately 99% reported having an overall positive experience, regardless of ethnicity. Notably, 58.3% of clients reported that they were able to get vaccinated earlier because of the neighborhood vaccination site, 98.4% of clients completed both vaccine doses, and 90.7% said that they were more likely to recommend COVID-19 vaccination to family and friends after their experience; these findings did not substantially differ according to ethnicity. There were 40.3% of vaccinated clients who said they still knew at least one unvaccinated person (64.6% knew \geq 3). Among clients who received both vaccine doses (n = 729), 91.0% said that after their vaccination experience, they had personally reached out to at least one unvaccinated person they knew (61.6% reached out to \geq 3) to recommend getting vaccinated; 83.0% of clients reported that one or more friends, and/or family members got vaccinated as a result of their outreach, including 18.9% who reported 6 or more persons got vaccinated as a result of their influence. In summary, this multi-component, "Motivate, Vaccinate, and Activate" community-based strategy addressing barriers to COVID-19 vaccination for the San Francisco Mission District's Latinx population reached the intended population, and vaccinated individuals served as ambassadors to recruit other friends and family members to get vaccinated.

Discussion

While COVID-19 vaccine uptake among Latinx persons has drifted upwards since the first 8 months [1, 40], this was viewed as related to the introduction and spread of the Delta variant which impacted the burden of infections, hospitalizations, and death borne, again, differentially in Latinx communities [40, 41]. In May 2021, Latinx persons were the most eager among all other racial/ethnic groups to get vaccinated, but rates of uptake lagged these other groups. This discrepancy highlights a fundamental issue for Latinx communities, namely, delayed access to vaccine.

Interventions that address communication and improve access to COVID-19 vaccines are a major part of increasing vaccine uptake and protecting Latinx communities from COVID-19. A variety of strategies have been summarized here to increase cultural tailored credibility and convenience for the vaccine while offsetting complacency. This work is delivered through partnerships between communities, academia, and local health departments for outreach education via town halls, promotora, social media, and then to make vaccine convenient to access through pop-up sites at workplaces and social gatherings. What might be suggested from these mostly descriptive reports is that efforts to address delayed COVID-19 vaccine uptake appear to be reactive, becoming operational after vaccine becomes locally available. Also, the summary of interventions for many localities comes across as a collection of separate individual efforts rather than coordinated and comprehensive programming. Work could be done during the vaccine's development phase to prepare the community, establish the infrastructure, and be ready to deliver prior to vaccine distribution to address issues of community concerns and access. Delays in development and implementation of these strategies endanger lives.

This review is not without limitations. The rapid format captures only what has been reported within the first 8 months of vaccine availability and detailed peer reviewed information was limited. Program evaluation was uncommon. The advantage of the rapid review is to retrieve and focus information in real time on what was being considered, organized, and implemented early. Google search limited to the top 50 articles per search term could be overly selective, missing important views and examples. The search terms that were selected also limited the scope of the review to community engagement strategies and other themes such as structural impediments were not included. Health equity is an essential consideration when building vaccination programs and a wider review is warranted. Another limitation is that the number and nature of the reporting precluded differentiated descriptions by Latinx subgroups or region; future work will need to address this.

In summary, this report raises the import of constructing a coordinated comprehensive strategy to produce, maintain, and sustain health equity in Latinx communities. Some of the points raised here are critical now for COVID-19 vaccine uptake, but more importantly point toward preparation and response to future health crises.

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Declarations

Conflict of Interest The authors declare competing interests.

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