



Sociopolitical antecedents influencing COVID-19 vaccine uptake in Pima County, Arizona

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ABSTRACT

Introduction: Vaccine hesitancy among marginalized populations particularly in the Hispanic community over the course of the COVID-19 pandemic has presented as a public health issue. This study examined the relationship between political affiliation and vaccination decisions of Hispanic adults in Pima County, Arizona.

Methods: Between January and October 2022, 623 participants completed surveys in English or Spanish after completing informed consent process. Information collected included sociodemographic, political affiliation and philosophy and COVID vaccination uptake. Participants were recruited at different community events in Southern Tucson, Pima County, Arizona. Participants received five dollars for completing the surveys. Data were analyzed with Stata version 16.1.

Results: Participants were 81.8 % Hispanic and 18.2 % non-Hispanic. On average, participants were 32.9 (SD ± 11.8) years of age with a median age of 31 (IQR: 23, 41). Participants who had a bachelor's degree or above had 2.9 times greater odds of being vaccinated compared to those who had less than a high school education (Adjusted odds ratio (aOR): 2.84; 95 % CI: 1.12, 7.22). Individuals identifying as politically liberal had 3.28 times higher odds of being vaccinated compared to those identifying as conservative (OR = 3.28; 95 % CI: 1.5, 7.16). Similarly, Democrats had 3.36 times higher odds of being vaccinated than Republicans (OR = 3.36; 95 % CI: 1.61, 7.01). People who were strongly religious had statistically significantly lower odds of recommending the vaccine to others as compared to those who self-reported as not being religious.

Conclusions: There was an association with Hispanic adults who aligned liberal or Democrat to express more favorable views toward vaccinations. Additionally, individuals who were more educated, less religious, and in better financial situations tended to be more favorable toward vaccinations in Arizona.

1. Introduction

Vaccine hesitancy was identified by the World Health Organization in 2019 as one of the top ten threats to global health [1]. Vaccine hesitancy in the United States among marginalized groups, particularly within Hispanic populations, poses a significant public health challenge [2]. Marginalized communities faced the brunt of the COVID-19 pandemic, with higher infection and death rates among racial ethnic minority populations [3]. Marginalized communities face higher rates of

vaccine hesitancy and lower vaccination rates. This challenge is compounded by the spread of misinformation and the politicization of COVID-19 and its preventive measures [2,4].

Various factors contribute to this hesitancy, including mistrust of vaccine manufacturers and administrators, fear of adverse effects, and concerns over exploitation [4]. A survey carried out by the KFF COVID Vaccine Monitor in November and December of 2020 found that only 36 % of Hispanic adults reported they would definitely get the COVID-19 vaccine if it were available, compared to 46 % of white adults who

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reported the same response [5]. Another study found that as of July 2022, Latino individuals were less likely to be vaccinated compared to their white counterparts [6].

Current literature has illustrated that there are numerous factors that contribute to low levels of vaccination uptake among Hispanic populations in the US. Numerous factors have been identified as influential in determining an individual's willingness to receive COVID-19 vaccines. Sociodemographic characteristics such as age, educational attainment, socioeconomic status, insurance coverage and living in rural areas have a well-established relationship with COVID-19 vaccine acceptance [7–9]. Other factors such as religion and political affiliation have also been found to influence COVID-19 vaccination intent and confidence [10–13].

Arizona had a significant surge by early 2022 more than 1.6 million COVID-19 cases that constituted approximately 23 % of the state's population, and 25,429 deaths [14]. According to the Arizona Department of Health Services, 27 % of COVID-19 cases in the state were among Hispanic population, who make up 31 % of the state's total population according to the U.S. Census Bureau [15,16]. However, vaccination rates among the Hispanic population in Arizona were lagging behind those of Whites. According to the Kaiser Family Foundation survey, based on the available data by race/ethnicity from January 2022, 58 % of the White population had received at least one vaccine dose compared to only 40 % of the Hispanic population in Arizona [17]. However, there remains a gap in the literature about the role of political affiliation, and political philosophy (whether one is liberal, or conservative) among Hispanic populations and how that influences vaccination rates in the state of Arizona. The primary objective of this study was to identify the antecedents of COVID-19 vaccine intention – including sociodemographic factors and political affiliations among a predominantly Hispanic population in Southern Arizona.

2. Methods

2.1. Study site and location

This study was carried out in Pima County, Southern Arizona, a county with a population of 1.06 million, with 50 % White (non-Hispanic), 39 % Hispanic and the remainder being Black, Asian and Native American. The median household income is \$64,323 and the median age being 39 years.

2.2. Ethics and consent

This study received an IRB-exempt status from the Institutional Review Board at the University of Arizona and was granted clearance for conducting human subjects research (IRB Completion #2107063899). All participants provided electronic written informed consent through Qualtrics before participating in the study.

2.3. Participants

To be included in the study, participants had to be 18 years or older, self-identify as residents of Pima County, being able to speak and write English or Spanish, and be willing and able to give informed consent. Recruitment occurred at various events with a large Hispanic presence. The surveys were completed on tablets that had the survey loaded in a Qualtrics platform, and participants received \$5.00 cash as compensation for participation. In addition, we had a QR code available at the events where potential participants could complete the survey on their smartphones as well. The research team consisting of a group of trained research assistants who were students from University of Arizona tabled at local events with a significant Hispanic presence. These events included the AZ Bilingual's Children's Day Festival, the TPD backpack event, community fairs, and high school career fairs. In addition, recruitment also took place at the University of Arizona's Hispanic

Student Center. Participants accessed the survey through QR codes with links to the online surveys. These links, containing both the Spanish and English versions of the survey.

2.4. Measures

Sociodemographic questions: The demographic questionnaire included general information items such as ethnicity, age, gender and occupation.

Coronavirus Anxiety Scale [18]: The CAS is a five-item scale (5-point Likert scale) self-report screening measure for severe anxiety associated with coronavirus. Respondents reported the frequency of anxiety-related symptoms during the past 2 weeks related to coronavirus. Scores of 9 or greater suggested anxiety.

Generalized Anxiety Disorder Assessment [19]: The GAD-7 is a seven-item instrument that is used to measure or assess the severity of generalized anxiety disorder. Each item asks the individual to rate the severity of his or her symptoms over the past two weeks. The GAD-7 score is calculated by assigning scores of 0, 1, 2, and 3, to the response categories of “not at all,” “several days,” “more than half the days,” and “nearly every day,” respectively, and then adding together the scores for the seven questions. GAD-7 total score for the seven items ranges from 0 to 21. Scores of 5, 10, and 15 represent cut-points for mild, moderate, and severe anxiety, respectively.

Center for Epidemiological Studies-Depression [20]: CES-D captures the frequency of feelings and behaviors over the past seven days and rated on a 4-point scale ranging from 0 (rarely or none of the time) to 3 (most or all of the time). The CES-D contains 20 items that are summed so that scores have a potential range from 0 to 60, with higher scores indicating greater frequency of depressive experiences.

Impact to Event Scale (revised) [21]: The IES-R is a 22-item self-report measure that assesses subjective distress caused by traumatic events. It is a revised version of the older version, the 15-item IES [22]. The IES-R contains 7 additional items related to the hyperarousal symptoms of PTSD, which were not included in the original IES. Respondents are asked to identify a specific stressful life event and then indicate how much they were distressed or bothered during the past seven days by each “difficulty” listed. Items are rated on a 5-point scale ranging from 0 (“not at all”) to 4 (“extremely”). The IES-R yields a total score (ranging from 0 to 88) and subscale scores can also be calculated for the Intrusion, Avoidance, and Hyperarousal subscales.

Family interaction: Adaptability, Partnership, Growth, Affection and Resolve (APGAR) Scale [23]: This instrument was developed to analyze and understand the functioning of a family system in a particular moment as perceived by one of its members. The APGAR scale is composed of five items that evaluate the dimensions of adaptation, partnership, growth, affect, and resolve within a family. The participants determine their level of disagreement or agreement with each of statement on a 5-point Likert scale, ranging from 1 (never) to 5 (always). All scores are added to obtain the overall score. A high score indicated that the subject enjoyed favorable support from the family.

Additional questions include sections of the CDC Vaccine Confidence Question Bank [24], political beliefs, vaccination status and vaccine acceptance.

2.5. Data analysis

Data was collected electronically on tablets using Qualtrics. Descriptive statistics were calculated for variables. These included counts and percentages for categorical variables, and mean with standard deviation, and median with Interquartile range for continuous variables. The data were analyzed using logistic regression (for vaccination status as the outcome) and linear regression (for the extent to which participants would recommend the vaccination as the outcome). Simple and multiple logistic regression were used to measure associations between vaccination status and factors which may influence

vaccination. For the extent to which participants would recommend the vaccine, simple and multiple linear regression were used to measure associations with factors which may influence vaccine recommendation. Tests of significance were 2-tailed ($P < 0.05$), and 95 % confidence intervals were reported. Individuals with missing data were excluded only from the affected analysis. All associations were considered significant at the $\alpha = 0.05$ level. All analyses were performed using Stata version 16.1 (StataCorp, College Station, TX).

3. Results

Sociodemographics of the participants: Between January and October 2022, 623 participants completed the surveys (488 English and 135 Spanish). Nearly one-in-three participants were (156; 29 %) were male, and six (1.1 %) did not identify as male or female, and four (0.7 %) preferred not to answer. The average age of the participants was 32.9 years ($SD \pm 11.8$), with a median age of 31 years (IQR: 23, 41) (Table 1). As seen in Figs. 1 and 2, the overall vaccination rate was 71.3 %, with rates seen among Republicans (73.3 %), Democrats (90.2 %) and members of other parties (76.1 %). Similarly, the rates among liberals, conservatives, and other were 92.2 %, 78.2 %, and 75.4 %, respectively. This may be due to a low rate of vaccination among those who did not answer the political affiliation and ideology questions. The mean overall vaccine recommendation level (on a 1–10 scale) was 7.87, with means among Republicans, Democrats and other of 7.12, 8.73, and 7.0, respectively. The means among conservatives, liberals and other were 7.24, 9.05, and 7.22, respectively (Figs. 1 and 2).

Determinants of Vaccination Uptake: Table 2 shows the determinants associated with vaccination uptake, both as unadjusted logistic regression models, and adjusted logistic regression models. In the unadjusted

logistic regression analysis, participants who had liberal political ideology, Democratic political affiliation, with higher education and Hispanic ethnicity had significantly higher odds of vaccination uptake. Participants who reported liberal political ideology had 3.28 (95 % CI: 1.5, 7.16) increased odds of vaccination uptake as compared to those who reported conservative ideology. Participants who were affiliated with the Democratic party had 3.36 times (95 % CI: 1.61, 7.01) increased odds of vaccination uptake as compared to Republicans.

Participants who had higher education (some college OR: 1.97; bachelor's degree or more OR: 3.01) had increased odds of vaccination uptake as compared to those with high school education or less. Those who reported Hispanic ethnicity had higher odds (OR: 5.5; 95 % CI: 3.77, 8.05) of vaccination uptake compared to those who reported non-Hispanic ethnicity. In the multivariable analysis, Democratic political affiliation (aOR: 2.84; 95 % CI: 1.12, 7.22) and education (some college aOR: 1.81, 95 % CI: 1.06, 3.1; bachelor's degree or more OR: 3.37, 95 % CI: 1.52, 7.45) were significantly associated with vaccination uptake after adjusting for age, gender, religiosity, and whether someone's religion influenced their vaccination decision.

Determinants of Vaccination Recommendation: Table 3 shows factors associated with vaccination recommendation. For vaccination recommendation, two similar sets of models were performed: unadjusted, bivariate models, and a full adjusted model including all variables considered. In the bivariate model, liberals more strongly recommended the vaccine than conservatives (beta = 1.8, 95 % CI: 0.81, 2.79). Similarly, Democrats recommended the vaccine more strongly than conservatives (Beta = 1.61, 95 % CI: 0.48, 2.75). Those who were strongly religious were significantly less likely to recommend the vaccine (beta = -1.64, 95 % CI: -2.63, -0.65). Those who had some college education were significantly more likely to recommend the vaccine than those with high school or less (Beta = 1.26; 95 % CI 0.54, 1.97), as were those with a bachelor's degree or above (Beta = 1.46, 95 % CI: 0.63, 2.28). There was a significant association between being Hispanic and recommending the vaccine in the simple linear regression model (beta: 1.001, 95 % CI: 0.11, 1.89).

In the full model adjusting for confounders, neither the association seen between political ideology and vaccine recommendation nor that between political party affiliation and vaccine recommendation persisted. However, those who were strongly religious were significantly less likely to recommend the vaccine (beta: -1.28, 95 % CI: -2.33, -0.25). After adjusting for confounders, both those with some college (beta: 0.89, 95 % CI: 0.18, 1.6) and those with a bachelor's degree or above (beta: 1.45, 95 % CI: 0.61, 2.3) significantly more strongly recommended the vaccine. The association between being Hispanic and vaccine recommendation did not persist after adjusting for confounders.

4. Discussion

Our study in a predominantly Hispanic population in Tucson, Arizona, found factors that influenced COVID-19 vaccination uptake was having Democratic political affiliation and higher education. Similarly, education and being strongly religiously were negatively associated with vaccination recommending to others. Clear distinctions are observed between individuals identifying as Democrats, Republicans, and Independents, further emphasizing the complexity of vaccine acceptance and recommendation within the population.

The results indicate a correlation between political affiliation, education, income, and religiosity with COVID-19 vaccination uptake. This aligns with existing literature, as a study by Zhang et al. investigated the effects of political affiliation, education, and religiosity on vaccine hesitancy among 751 participants in August 2022 found that among participants with Democratic party affiliation, 11 % did not receive the COVID-19 vaccine, and 33 % expressed vaccine hesitancy as compared to the Republican and independent party participants, where 16 % and 27 % did not receive the COVID-19 vaccine and 47 % and 45 % expressed vaccine hesitancy, respectively [25]. In a large scoping review

Table 1
Sociodemographic characteristics of participants in Pima County, Arizona, 2021–2023 (N = 623).

Variable	n (%) (or Mean \pm SD [Median (IQR)])
Vaccination status	
Yes	444 (71.3)
No	179 (28.7)
Recommendation of vaccination	Mean \pm SD: 7.87 \pm 3.1 Median (IQR): 10 (6, 10)
Age (in years)	Mean \pm SD: 32.9 \pm 11.8 Median (IQR): 31 (23, 41)
Gender	
Male	157 (30.1)
Female	364 (69.9)
Political ideology leaning	
Conservative	78 (14.7)
Liberal	166 (31.2)
Unsure	288 (54.1)
Political party	
Republican	60 (11.3)
Democrat	205 (38.5)
Other	268 (50.3)
Religiosity	
Not religious/Don't know	117 (23.0)
Slightly/moderately religious	285 (56.0)
Strongly religious	107 (21.0)
Education	
HS/equivalent or less	222 (41.7)
Some college	197 (37.0)
Bachelor's or above	114 (21.4)
Ethnicity	
Hispanic	440 (81.8)
Not Hispanic	98 (18.2)
Religion Affects Vaccination Decision	
No/Don't Know	464 (86.6)
Yes	72 (13.4)

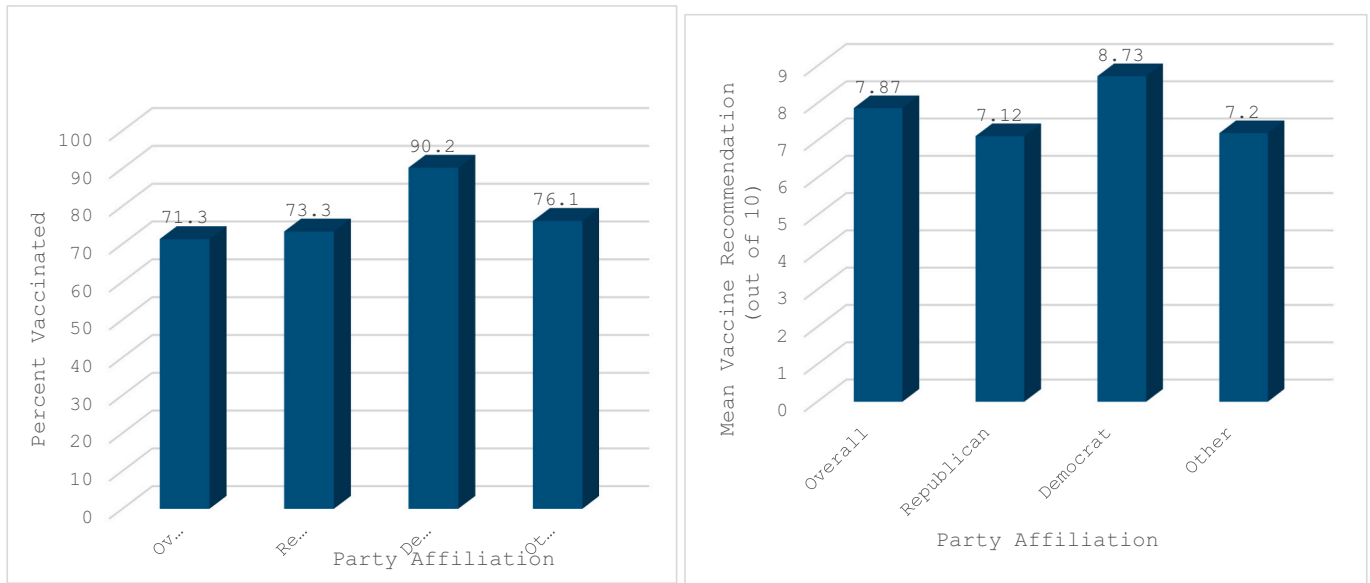


Fig. 1. Vaccination Status and Vaccine Recommendation by Party Affiliation.

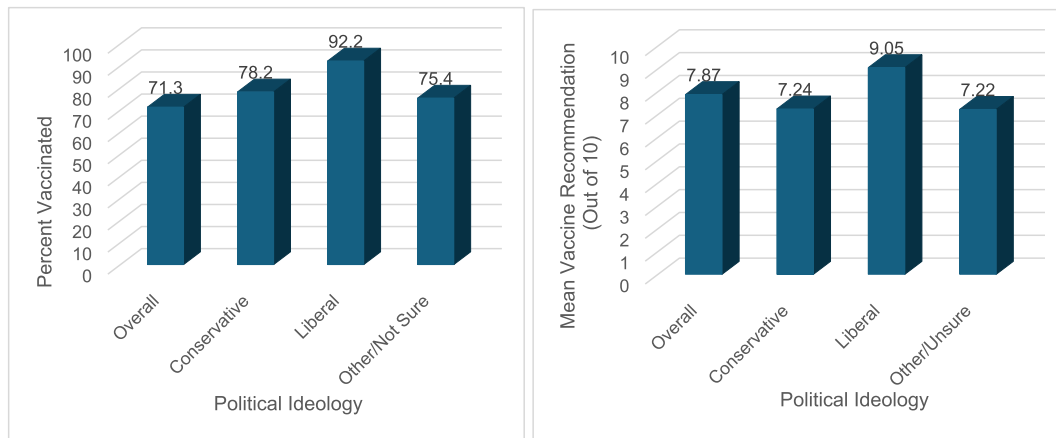


Fig. 2. Vaccination Rate and Vaccine Recommendation by Political Ideology.

on vaccine hesitancy, political inclination toward non-Democrats in the U.S. ($n = 8$) and non-liberals ($n = 8$) were associated with vaccine hesitancy [26]. Another study conducted a comprehensive, data-driven population-level statistical analysis at the county level and found political affiliation, as determined by the proportion of votes received by the Republican candidate in the 2020 presidential election, had the strongest association with the percent of the population that received no COVID-19 vaccine. Across all models presented, political affiliation, namely the percentage of voters who voted for Donald Trump in the 2020 presidential election, had the strongest association with COVID-19 unvaccinated percentage in the U.S. These results are consistent with previous studies at the individual level [27,28] and at the population level [29–31].

Education and religiosity were common contextual factors associated with reduced vaccine uptake and recommending the vaccine to others. Higher levels of educational attainment were significantly associated with increased vaccination uptake in several studies [9,32]. Dong et al conducted a population level analysis at county level, which added more evidence to the multitude of research showing that socioeconomic and demographic factors such as education were consistently associated with public health outcomes such as vaccine uptake, which underscores the longstanding role of inequality in the U.S. driving

disparate health outcomes. Higher level of education in the participants is associated with the possession of correct information on COVID-19 and less susceptibility to misinformation [33]. With regard to religiosity, one study examined the relationship between the percentage of followers of different religions and the COVID-19 vaccination rates in different countries. The study found that religiosity at the level of cross-country comparison analyses was not associated with the COVID-19 vaccination rates, except for Christianity [34]. Our results were also similar to several studies that found an inverse relationship with political affiliation, vaccine uptake and recommending the vaccine to others [35,36].

Our study had several limitations. First, our study used a non-probability convenience sample which may not be representative of the general population as our participants were more predominantly Hispanics from Pima County in Arizona leading to a selection bias. We did not collect the information about which event each participant attended, preventing us from adjusting for clustering. Finally, there may be information bias as all responses were self-reported with no verification of actual vaccination uptake. Despite these limitations, the strength of our study is our study population, as there is very little information about Hispanic population and their vaccine intentions. Since we collected the data from community settings, we believe that the findings from our

Table 2

Factors associated with COVID vaccination uptake among participants in Pima County, Arizona (N = 623).

Variable	Vaccination Uptake	
	Univariate OR (95 % CI)	Adjusted Model AOR (95 % CI)
Age	1.01 (0.99, 1.02)	1.01 (0.99, 1.03)
Gender (Female vs. Male)	0.83 (0.51, 1.37)	0.76 (0.44, 1.32)
Political Ideology		
Conservative	Ref.	Ref.
Liberal	3.28 (1.5, 7.16)	1.49 (0.56, 3.99)
Unsure	0.85 (0.47, 1.55)	0.61 (0.26, 1.41)
Political Affiliation		
Republican	Ref.	Ref.
Democrat	3.36 (1.61, 7.01)	2.84 (1.12, 7.22)
Other	1.16 (0.61, 2.19)	1.43 (0.61, 3.38)
Religiosity		
Not religious/Don't know	Ref.	Ref.
Slightly/moderately religious	0.66 (0.36, 1.21)	0.69 (0.35, 1.35)
Strongly religious	0.52 (0.26, 1.04)	0.5 (0.22, 1.12)
Education		
HS/equivalent or less	Ref.	Ref.
Some college	1.97 (1.21, 3.22)	1.81 (1.06, 3.1)
Bachelor's or above	3.01 (1.54, 5.87)	3.37 (1.52, 7.45)
Ethnicity (Hispanic vs. non-Hispanic)	5.5 (3.77, 8.05)	1.35 (0.72, 2.5)
Religion Influenced Vaccine		
No/Don't Know	Ref.	Ref.
Yes	0.66 (0.36, 1.17)	0.79 (0.4, 1.56)

Ref = Odds ratio of 1.00.

OR = odds ratio; aOR = adjusted odds ratio; CI = confidence interval. Bold text indicates a statistically significant aOR at $p \leq 0.05$.

Table 3

Factors associated with vaccination recommendation among participants in Pima County, Arizona (N = 623).

Variable	Vaccination Recommendation	
	Univariate beta (95 % CI)	Adjusted Model beta (95 % CI)
Age (in years)	-0.01 (-0.04, 0.02)	0.001 (-0.03, 0.03)
Gender (Female vs. Male)	0.06 (-0.62, 0.73)	-0.42 (-1.09, 0.25)
Political Ideology		
Conservative	Ref.	Ref.
Liberal	1.8 (0.81, 2.79)	0.75 (-0.46, 1.97)
Unsure	-0.02 (-0.97, 0.92)	-0.42 (-1.57, 0.73)
Political Affiliation		
Republican	Ref.	Ref.
Democrat	1.61 (0.48, 2.75)	0.95 (-0.38, 2.27)
Other	0.08 (-1.05, 1.21)	0.15 (-1.17, 1.47)
Religiosity		
Not religious/Don't know	Ref.	Ref.
Slightly/moderately religious	-0.55 (-1.31, 0.21)	-0.35 (-1.12, 0.41)
Strongly religious	-1.64 (-2.63, -0.65)	-1.28 (-2.33, -0.23)
Education		
HS/equivalent or less	Ref.	Ref.
Some college	1.26 (0.54, 1.97)	0.89 (0.18, 1.6)
Bachelor's or above	1.46 (0.63, 2.28)	1.45 (0.61, 2.3)
Ethnicity (Hispanic vs. non-Hispanic)	1.001 (0.11, 1.89)	0.66 (-0.27, 1.6)
Religion Influenced Vaccine		
No/Don't Know	Ref.	Ref.
Yes	-0.98 (-1.97, 0.02)	-0.54 (-1.56, 0.48)

Ref = Regression Coefficient of 0.

Bold text indicates a statistically significant at $p \leq 0.05$.

study would provide information on factors that may be associated with vaccine intention and highlight areas for future study and educational campaigns.

Addressing these disparities demands a multifaceted approach. Tailored, culturally sensitive outreach strategies, as exemplified by community collaborations and event-based recruitment methods, hold

promise in reducing the vaccination gap among Hispanic communities in Tucson. Furthermore, acknowledging the profound influence of political affiliation on vaccine hesitancy is critical for designing effective public health campaigns that resonate with diverse ideological groups. To enhance our understanding and better tailor interventions, future research should delve deeper into the political leanings of Hispanic populations, both at the national and regional levels. Exploring their willingness to recommend the COVID-19 vaccine is also essential for designing effective public health campaigns. These findings extend beyond Tucson's Hispanic population, offering valuable insights for addressing disparities in vaccine acceptance and hesitancy among various minority communities throughout the United States. The lessons learned from this study have broader implications, contributing to the ongoing efforts to promote vaccine equity and public health in an increasingly diverse nation.

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Role of the Sponsor

The funder had no role in the study design, data collection, management, analysis, or interpretation of the data, and preparation, review, or approval of the manuscript.

CRediT authorship contribution statement

Sam Rodriguez: Writing – review & editing, Writing – original draft, Project administration, Investigation, Formal analysis, Data curation. **Kailey Haider:** Writing – original draft, Methodology, Formal analysis. **Famesh Patel:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation. **Grace Thatigiri:** Writing – review & editing, Methodology, Investigation, Data curation. **Benjamin Pope:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis. **Jasen Albana:** Writing – original draft, Methodology, Formal analysis. **Sohail R. Daulat:** Writing – review & editing, Writing – original draft, Visualization, Formal analysis. **Purnima Madhivanan:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Conceptualization. **Karl Krupp:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Karl Krupp reports financial support was provided by Programa De Investigacion En Migracion Y Salud (PIMSA), which is a consortium administrated by the Health Initiative of the Americas (HIA) of the School of Public Health, University of California Berkeley. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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