

Intention to Obtain a COVID-19 Vaccine Among Brazilian Immigrant Women in the U.S.

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Abstract

Background: COVID-19 has disproportionately impacted low-income communities and communities of color. Widespread uptake of COVID-19 vaccines is necessary to prevent ongoing community transmission. Little is known about the acceptability of COVID-19 vaccines among immigrant communities, many of which have been disproportionately impacted by the pandemic. Our goal was to gauge COVID-19 vaccine intentions among Brazilian immigrant women living in the U.S.

Methods: We conducted an online survey in Portuguese and English among a convenience sample of Brazilian immigrant women ages 18 years and older. Women were recruited through online advertisements by community-based organizations and social media groups to complete a survey that assessed intention to get a COVID-19 vaccine, attitudes toward vaccines, and perceptions about the pandemic.

Results: Of the total sample (N=364), most (70.9%) indicated they would take a COVID-19 vaccine. In bivariate analyses, vaccine intentions were significantly associated with perceptions about the severity of the pandemic, trusted sources of health information, and number of years lived in the U.S. Multinomial logistic regression models revealed that those who did not intend to be vaccinated had lived a longer time in the U.S. (OR: -0.12 95% CI: -0.19, -0.05), perceived the pandemic to be only a minor problem (OR: 1.44, 95% CI: 0.51, 2.37), and trusted information from social networks (OR: -2.04, 95% CI: -3.35, -0.73) and private news sources (OR: -1.76, 95% CI: -2.85, -0.68).

Conclusions: While the majority of women reported they would get a COVID-19 vaccine, efforts to reach those who may be hesitant should target those who have lived in the U.S. for a longer time and do not perceive the pandemic to be a major crisis. Healthcare providers may be particularly suited to deliver this information given high levels of trust.

Background

The COVID-19 pandemic has devastated communities across the world, completely shifting our way of life at an unforeseen human cost. The pandemic has worsened long-standing health inequities in the U.S., with a disproportionate number of cases and deaths among Black people and non-Black Latinos (1–3). Although these groups represent only approximately 30% of the general U.S. population, 55% of COVID-19 cases have occurred among non-Black Latinos and Black people (4). In a study of community-level factors associated with disparities in COVID-19 incidence, communities with a higher proportion of foreign-born, non-citizens had more COVID-19 cases (5). Various commentaries further highlight the disproportionate burden of COVID-19 among immigrant communities and call for the prioritization of vaccine access within these vulnerable communities (6–11). However, to date, there are no published studies of vaccine intentions among immigrant populations in the U.S.

In this study, we focus on Brazilian immigrants, both because they represent a growing number of immigrants to the U.S. and because there is little data available on their health status. In 2017, it was

estimated that there were more than 450,000 Brazilians living in the U.S., although this may be inaccurate because a significant proportion of the Brazilian immigrant population do not have legal documents and may be underrepresented in the Census(12). Indeed, the Brazilian Consulate-General in Boston, MA estimates that there are 350,000 Brazilians within their jurisdiction alone (12, 13). Another aspect of the relative “invisibility” of Brazilians is since they are categorized in the U.S. as Hispanic (e.g., Spanish-speaking), but few Brazilians identify with this label since they speak Portuguese. Some do not even identify with the term Latino/a, in part because Brazilian culture has strong African, Indigenous, and Portuguese influences, rather than Spanish (13, 14). Thus, even as information about the impact of COVID-19 among immigrant populations becomes available, it may be difficult to assess the impact among Brazilians as a distinct ethnic group. This is of concern as Brazilians are over-represented in low-wage, public-facing jobs that frequently lack paid sick-leave or opportunities to work from home, putting them at greater risk for exposure to COVID-19(1, 6–8, 10, 11, 15). Like many immigrant communities, they also face myriad barriers to access of healthcare, including lack of insurance and low English language proficiency (10).

The goal of this study was to assess COVID-19 vaccine intentions among Brazilian immigrants and to gather information that may inform future vaccination efforts. We chose to focus on Brazilian *women* because they are often the ‘gatekeepers’ to healthcare for their families, arranging medical appointments for their children and partners (16, 17). Additionally, studies have reported that women may be less likely to intend to be vaccinated for COVID-19 than men (18). This community-engaged study was conducted by investigators at Tufts University, the Brazilian Women’s Group (verdeamarelo.org/bwg/), and local city officials.

Methods

Data for this analysis are from a larger study on Brazilian immigrant women’s health priorities and experiences. A convenience sample was recruited from Brazilian social media pages (e.g., Facebook, WhatsApp) and through outreach by collaborating community partners (e.g., health and social service providers in Boston, MA), who posted information and a link to the study on their social media pages. Those eligible to participate were Brazilian women age 18 years or older who resided in the U.S. The online survey was offered in Portuguese and English; respondents could choose based on their language preference. The survey was translated by an American Translators Association certified translator and was reviewed by native Portuguese speakers and an expert in Portuguese linguistics to ensure that the translation was linguistically and culturally accurate. Survey respondents were provided with a financial incentive (\$20 gift card) for survey completion, which took an average of 18.5 minutes. Data was collected between July and August 2020 and all study procedures were approved by the Institutional Review Board at Tufts University, Medford, MA, USA.

We assessed our primary outcome (COVID-19 vaccine intentions) by asking: *“If a vaccine became available to prevent the Coronavirus, would you want to get it?”* (“yes,” “no,” “don’t know”). For those who responded that they would not get the vaccine we asked, *“Why not?”* and respondents were able to enter

free text responses. We also assessed prior testing for and diagnosis of COVID-19 (*"Have you been tested for the Coronavirus? If so, what was the result?"*) with response options: *"I have been tested and I tested positive (I had coronavirus)," "I have been tested and I tested negative (I did not have coronavirus)," "I have been tested and I do not know the result,"* or *"I have not been tested."* In addition, respondents were asked, *"Whether or not you have had a Coronavirus test, has a doctor or another healthcare professional diagnosed you as having or probably having Coronavirus?"* ("yes," "no," "don't know").(19)

Given that the Brazilian president has downplayed the severity of the COVID-19 pandemic (20), we also assessed perceptions regarding the seriousness of the pandemic with a question asking respondents whether they thought that the pandemic was *"a significant crisis," "a serious problem but not a crisis," "a minor problem,"* or *"not a problem at all."*(21). To plan future interventions, we also wanted to know about trusted source of health information, so we asked *"What source do you trust the most to give you accurate up-to-date information about health?"* with response options: doctor/physician, a nurse practitioner/nurse; network news; family member or friends; social media; internet (e.g., WebMD, Google); public health agencies (e.g., Centers for Disease Control and Prevention); governmental agencies or officials; pharmaceutical companies; religious or faith leaders.

Socio-demographic characteristics were assessed using items from the Brazilian Census(22), including race/ethnicity (White/Black/Indigenous/Asian/Pardo ["mixed"]), and educational attainment. We also assessed age, household income, and insurance status using items from the Behavioral Risk Factor Surveillance System (23). We obtained participant zip codes since the survey was not limited to one geographic area. We asked about the number of years lived in the U.S., because prior evidence suggests that longer time spent living in the U.S. is associated with adoption of health behaviors that are normative in the U.S. (24–26). Given that acculturation appears to change beliefs, attitudes, and values regarding health behaviors and healthcare among immigrants (27), we assessed nativity, time living in the U.S., as well as language spoken at home and with friends.

Analysis

We eliminated respondents who had missing data on vaccine intentions (n = 1), leaving a final analytic sample of N = 364. Descriptive statistics, including percentages, means, standard deviations, and ranges, were produced for all variables. We evaluated bivariate associations between vaccination intentions (outcome), key independent variables (e.g., COVID-19 experiences and perceptions, trusted sources of information) with Chi-square and ANOVA tests (19).

Before analysis, we combined categories for some variables, due to small cell sizes (n < 10). Specifically, we re-categorized answers for marital status (into *"formerly married or living as married," "married or living as married,"* and *"single, never married"*), perceived significance of pandemic (*"serious problem but not a crisis," "a minor problem,"* and *"not a problem at all"* combined into one category, *"minor"* versus *"a significant crisis"* relabeled as *"major"*), and most trusted source of health information (doctor/physician and nurse practitioner/nurse combined to *"healthcare provider"; "public health agencies"* and

“governmental agencies” combined to “*public agencies*”; “social media” and “family members or friends” combined to make “*social networks*”; “internet” and “network news” combined “*private news sources*”).

Variables associated with vaccine intentions ($p < 0.05$) in bivariate analyses and socio-demographic characteristics were included in multivariate models. Two multinomial logistic regression models were run to examine relationships between vaccine intentions, independent variables, and socio-demographic characteristics. The models compared those who did not intend to be vaccinated with those who reported that they would get a vaccine (“yes” vs “no”), as well as with those who reported that they were unsure about vaccine intention (“unsure” vs “no”). Variables were added in blocks with the first model examining socio-demographic demographics (age, marital status, income, time in the U.S.). The second model included those socio-demographics, as well as perceived significance of the pandemic, and most trusted source of health information (28, 29). Statistical significance was considered at the $p < 0.05$ level for the final model. Data analysis was generated using Stata software.(30)

Analysis of free text responses (reasons for not wanted vaccine) was done by thematic analysis. Based on published literature on vaccine hesitancy (31), we categorized rationale in terms of vaccine concerns (e.g., vaccine had not been fully tested, could have serious side effects, was not effective) and trust in authorities charged with developing and/or administering the vaccine.

Results

Characteristics of study participants

A total of 364 Brazilian women were included in the analysis, with most (92.6%) completing the survey in Portuguese. The mean age was 39.30 years (SD = 11.86). Approximately two-thirds (63.2%) reported their race as White, and a quarter (25.3%) reported themselves as Pardo (mixed-race). Notably, a majority (78.0%) identified as “Latina,” yet only 5.8% identified as “Hispanic,” which supports previous reports that Brazilians do not identify as Hispanic (13, 14, 32). The vast majority of women (97%) were born in Brazil, with the average time living in the U.S. being 11.81 years (SD = 9.09, range = 0.25-40). Most lived in Massachusetts (70.3%), with smaller percentages from New Jersey (6.0%), Florida (5.8%), and California (5.2%). Nearly all participants (99.7%) spoke Portuguese and a large portion (73.9%) also spoke English. Over half (51.4%) reported an annual household income of less than \$50,000. Nearly half (49.5%) had completed tertiary education (equivalent to a U.S. college degree). The majority (68.4%) reported being married or living as married. Most were Catholic (32.7%) or another Christian religion (30.8%). More than a third (35.4%) had public insurance and 19.5% were uninsured. The majority (72.5%) reported that they had not been tested for COVID-19; only 4.4% reported they had both been tested for and diagnosed with COVID-19.

COVID-19 vaccine intentions

Most (70.9%) said they would get a COVID-19 vaccine and 18.1% were unsure. Those who reported that they would not be vaccinated reported the reasons (in free text) as: concerns about the vaccine: that a

vaccine had not been fully tested (30.9%), could have serious side effects (17.6%), or was not effective (8.8%). In terms of trust, participants reported that they would not get vaccinated due to mistrust of the government (8.8%) and other systems supporting the production of the vaccine (10.3%), as well as general mistrust of vaccines (e.g., “I’ve never taken a vaccine in my life”) (8.8%).

Bivariate results

Participants who considered the pandemic to be a minor problem were less likely to intend to be vaccinated compared to those who considered it a significant crisis (53.4% vs. 75.9%, $p < 0.001$). Those whose most trusted sources of health information were private news sources or social networks were less likely to report that they would get the vaccine compared to those who listed their most trusted source of information as healthcare providers (62.7% vs. 73.4%, $p = 0.001$). Those who had lived in the U.S. for more than 19 years were less likely to report that they would get the vaccine, compared to those who had lived in the U.S. for 4 years or less (61.6% vs 84%, $p = 0.002$).

Multivariate analysis (Table 2)

Table 1
 Characteristics of sample, by vaccine intentions (N = 364)

	Total (N = 364)	Intend to be vaccinated (N = 258; 70.9%)	Do not intend to be vaccinated (N = 40; 11.0%)	Unsure about vaccination (N = 66; 18.1%)	P- value
Age (mean = 39.30, SD = 11.86)					0.160
18–34	128	99 (77.3%)	9 (7.0%)	20 (15.6%)	
35–64	227	154 (67.8%)	30 (13.2%)	43 (18.9%)	
65+	8	5 (62.5%)	1 (12.5%)	2 (25.0%)	
Missing	1	0	0	1 (100%)	
Race (select all that apply)					N/A
White	230	165 (71.7%)	24 (10.4%)	41 (17.8%)	
Black	32	23 (71.9%)	5 (15.6%)	4 (12.5%)	
Indigenous	10	7 (70.0%)	2 (20.0%)	1 (10.0%)	
Asian	5	4 (80.0%)	1 (20.0%)	0	
Pardo	92	64 (69.6%)	9 (9.8%)	19 (20.7%)	
Other	22	15 (68.2%)	3 (13.6%)	4 (18.2%)	
Missing	1	1 (100%)	0	0	
Latina					0.525
Yes	286	204 (71.3%)	33 (11.5%)	49 (17.1%)	
No	50	32 (64.0%)	6 (12.0%)	12 (24.0%)	
Unsure	28	22 (78.6%)	1 (3.6%)	5 (17.9%)	
Missing	0	0	0	0	
Hispanic					0.276

*Total varies due to missing responses; percentages may not total 100% due to rounding

**“Missing” refers to the number of people who were asked the question but did not respond

*For questions where participants could select multiple answers, the percentage was calculated using the number of people asked the question. For these questions, the percentage will not total 100%

*Defined as Umbanda, Candomblé, Espiritist

	Total (N = 364)	Intend to be vaccinated (N = 258; 70.9%)	Do not intend to be vaccinated (N = 40; 11.0%)	Unsure about vaccination (N = 66; 18.1%)	P- value
Yes	21	12 (57.1%)	6 (28.6%)	3 (14.3%)	
No	328	236 (72.0%)	33 (10.0%)	59 (18.0%)	
Unsure	15	10 (66.7%)	1 (6.7%)	4 (26.7%)	
Missing	0	0	0	0	
Nativity					0.091
U.S.	11	8 (72.7%)	3 (27.3%)	0	
Brazil	353	250 (70.8%)	37 (10.5%)	66 (18.7%)	
Missing	0	0	0	0	
Time in U.S					0.002
0–4 years	106	89 (84.0%)	4 (3.8%)	13 (12.3%)	
> 4–9 years	72	52 (72.2%)	4 (5.6%)	16 (22.2%)	
> 9–19 years	89	56 (62.9%)	15 (16.9%)	18 (20.2%)	
> 19–40 years	86	53 (61.6%)	14 (16.3%)	19 (22.1%)	
Born in U.S.	11	8 (72.7%)	3 (27.3%)	0	
Missing	0	0	0	0	
Language (select all that apply)					N/A
Portuguese	363	257 (70.8%)	40 (11.0%)	66 (18.2%)	
English	269	192 (71.4%)	30 (11.2%)	47 (17.5%)	
Spanish	103	71 (68.9%)	14 (13.6%)	18 (17.5%)	
Other	25	17 (68.0%)	2 (8.0%)	6 (24.0%)	
Missing	0	0	0	0	

*Total varies due to missing responses; percentages may not total 100% due to rounding

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	Total (N = 364)	Intend to be vaccinated (N = 258; 70.9%)	Do not intend to be vaccinated (N = 40; 11.0%)	Unsure about vaccination (N = 66; 18.1%)	P- value
Household Income					0.592
<\$10,000	65	46 (70.8%)	7 (10.8%)	12 (18.5%)	
\$15,000-\$25,000	57	38 (66.7%)	7 (12.3%)	12 (21.1%)	
\$25,001-\$50,000	65	46 (70.8%)	5 (7.7%)	14 (21.5%)	
\$50,001-\$75,000	61	48 (78.7%)	4 (6.6%)	9 (14.8%)	
\$75,001-\$100,000	40	28 (70.0%)	6 (15.0%)	6 (15.0%)	
\$100,000+	50	33 (66.0%)	10 (20.0%)	7 (14.0%)	
Unsure	26	19 (73.1%)	1 (3.8%)	6 (23.1%)	
Missing	0	0	0	0	
Education					0.553
< Primary education	24	14 (58.3%)	4 (16.7%)	6 (25.0%)	
Complete primary education	37	24 (64.9%)	5 (13.5%)	8 (21.6%)	
Complete secondary education	117	88 (75.2%)	10 (8.5%)	19 (16.2%)	
Complete tertiary education	180	129 (71.7%)	19 (10.6%)	32 (17.8%)	
Unsure	6	3 (50.0%)	2 (33.3%)	1 (16.7%)	
Missing	0	0	0	0	
Marital Status					0.252
Single, never married	64	47 (73.4%)	4 (6.3%)	13 (20.3%)	
Married or living as married	249	170 (68.3%)	33 (13.3%)	46 (18.5%)	

*Total varies due to missing responses; percentages may not total 100% due to rounding

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*Defined as Umbanda, Candomblé, Espiritist

	Total (N = 364)	Intend to be vaccinated (N = 258; 70.9%)	Do not intend to be vaccinated (N = 40; 11.0%)	Unsure about vaccination (N = 66; 18.1%)	P- value
Formerly married or living as married	51	41 (80.4%)	3 (5.9%)	7 (13.7%)	
Missing	0	0	0	0	
Religion					0.063
Protestant	42	33 (78.6%)	2 (4.8%)	7 (16.7%)	
Catholic	119	87 (73.1%)	8 (6.7%)	24 (20.2%)	
Other Christian	112	69 (61.6%)	19 (17.0%)	24 (21.4%)	
Other Brazilian*	26	22 (84.6%)	2 (7.7%)	2 (7.7%)	
Unaffiliated	47	37 (78.7%)	4 (8.5%)	6 (12.8%)	
Other	17	9 (52.9%)	5 (29.4%)	3 (17.6%)	
Don't Know	1	1 (100%)	0	0	
Missing	0	0	0	0	
Health Insurance					0.465
None	71	54 (76.1%)	5 (7.0%)	12 (16.9%)	
Private	152	104 (68.4%)	20 (13.2%)	28 (18.4%)	
Public	129	86 (66.7%)	15 (11.6%)	28 (21.7%)	
Unsure	18	14 (77.8%)	0	4 (22.2%)	
Missing	0	0	0	0	
COVID Test					0.896
Tested positive	16	13 (81.3%)	2 (12.5%)	1 (6.3%)	
Tested negative	83	59 (71.1%)	10 (12.0%)	14 (16.9%)	
Test results unknown	1	1 (100%)	0	0	

*Total varies due to missing responses; percentages may not total 100% due to rounding

**"Missing" refers to the number of people who were asked the question but did not respond

*For questions where participants could select multiple answers, the percentage was calculated using the number of people asked the question. For these questions, the percentage will not total 100%

*Defined as Umbanda, Candomblé, Espiritist

	Total (N = 364)	Intend to be vaccinated (N = 258; 70.9%)	Do not intend to be vaccinated (N = 40; 11.0%)	Unsure about vaccination (N = 66; 18.1%)	P- value
Not been tested	263	185 (70.3%)	28 (10.6%)	50 (19.0%)	
Missing	1	0	0	1 (100%)	
Significance of Pandemic					0.000
Major	286	217 (75.9%)	21 (7.3%)	48 (16.8%)	
Minor	78	41 (52.6%)	19 (24.4%)	18 (23.1%)	
Missing	0	0	0	0	
Trusted Sources of Health Information					0.001
Healthcare provider	199	147 (73.9%)	16 (8.0%)	36 (18.1%)	
Public agency	56	43 (76.8%)	3 (5.4%)	10 (17.9%)	
Social networks	22	14 (63.6%)	7 (31.8%)	1 (4.5%)	
Private networks	45	28 (62.2%)	11 (24.4%)	6 (13.3%)	
Missing	42	26 (61.9%)	3 (7.1%)	13 (31.0%)	
*Total varies due to missing responses; percentages may not total 100% due to rounding					
**“Missing” refers to the number of people who were asked the question but did not respond					
*For questions where participants could select multiple answers, the percentage was calculated using the number of people asked the question. For these questions, the percentage will not total 100%					
*Defined as Umbanda, Candomblé, Espiritist					

Table 2
Multinomial logistic regression comparing those who did versus those who did not intend to vaccinate (N = 364)

	Model 1	Model 2
	AOR (95% CI)	AOR (95% CI)
Age	0.02 (-0.03, 0.07)	0.02 (-0.04, 0.07)
Marital Status		
Married or living as married	-1.23 (-2.62, 0.16)	-0.92 (-2.55, 0.70)
Formerly married/living as married	0.21 (-1.58, 2.00)	-0.08 (-2.12, 1.96)
Income		
Less than \$10,000	-0.27 (-1.52, 0.99)	-0.22 (-1.66, 1.22)
\$25,001 - \$50,000	0.83 (-0.52, 2.17)	1.34 (-0.20, 2.88)
\$50,001- \$75,000	1.24 (-0.13, 2.60)	1.45 (-0.20, 3.10)
\$75,001-\$100,000	0.49 (-0.78, 1.77)	0.93 (-0.71, 2.57)
Higher than \$100,000	0.25 (-0.93, 1.44)	-0.05 (-1.42, 1.32)
Don't know	1.28 (-0.94, 3.51)	1.02 (-1.36, 3.41)
Time in US	-0.10 (-0.16, -0.04)	-0.12 (-0.19, -0.05)
Trusted Source of Health Information		
Public agency		0.11 (-1.30, 1.52)
Social networks		-2.04 (-3.35, -0.73)
Private news source		-1.76 (-2.85, -0.68)
Significance of Pandemic		
Major		1.44 (0.51, 2.37)

Except for time spent in the U.S., none of the socio-demographic characteristics included in Model 1 (age, marital status, income) were significantly associated with vaccine intentions. The model controlled for age, marital status, and income, and found that participants were significantly less likely to intend to get a vaccine if they had spent more time living in the U.S. (OR: -0.10, 95% CI: -0.16, -0.04). In Model 2, perceived severity of the pandemic and most trusted source of health information were associated with intention to vaccinate after controlling for age, marital status, income, and time in the U.S. Specifically, participants who perceived the pandemic to be only a minor issue were less likely to say they would be vaccinated compared to those who identified the pandemic as a major crisis (OR: 1.44, 95% CI: 0.51, 2.37). Additionally, those who reported that their most trusted sources of health information were social

networks (i.e., social media and family or friends) or private news sources (i.e., network news and internet) were significantly more likely to report that they would not be vaccinated compared with those who reported healthcare professionals (doctors and nurse practitioners) as their most trusted sources of health information (social networks – OR: -2.04, 95% CI: -3.35, -0.73; private news sources – OR: -1.76, 95% CI: -2.85, -0.68). Time in the U.S. was also significant in the second model, with participants who had lived longer in the U.S. reporting that they were significantly less likely to intend to get the vaccine (OR: -0.12, 95% CI: -0.19, -0.05). We did not find differences in findings when we ran the same multivariable models comparing those who reported that they would be vaccinated versus those who reported that they were unsure.

Discussion

Most of the Brazilian immigrant women in this study reported that they would accept a COVID-19 vaccine. In multivariate analyses controlling for a range of socio-demographic factors, those who perceived the pandemic to be only a minor problem and those who most trusted information from private news sources and social networks were more likely to report that they would not take the vaccine. Additionally, we found evidence that longer periods of time spent living in the U.S. was associated with being less likely to intend to vaccinate. To our knowledge, this is the first study to assess COVID-19 vaccine intentions among an immigrant population in the U.S.

Our finding that 70.9% of Brazilian immigrant women intended to be vaccinated is aligned with recent national polls which report that 50–74% of percent of U.S. adults intended to be vaccinated (33–37). Polls and surveys have generally found that individuals more likely to accept vaccination were male, non-Hispanic White, and had higher levels of education and income (34, 38). It is possible that our finding of relatively high vaccine intentions among these women with lower incomes may be related to the high level of vaccine acceptance in Brazil. For example, 73% of adults age 60 and older living in Brazil received a flu vaccine in 2015–2016 (39), compared with only 63% of U.S adults of the same age during the same year (40). In a large nationally-representative survey done in Brazil in August, 2020, 89% of respondents said that they intended to get the COVID-19 vaccine when it became available (41). The high level of vaccine acceptance in Brazil (as opposed to the U.S.) may also help to explain our finding that the number of years living in the U.S. was negatively associated with intention to get the vaccine.

Our observation that the perceived severity of the pandemic was associated with vaccine intentions is not surprising. In general, perceived severity of illness has been associated with vaccine uptake of the human papilloma virus (HPV) and influenza vaccines (42–44). In addition, Reiter, et al. (2020) found that greater perceived severity of the pandemic was associated with increased likelihood of accepting the COVID-19 vaccine in a large U.S. sample (35). We also found that those who had high levels of trust in health information from healthcare providers were more likely to have positive vaccine intention, while those who trusted social networks and private news sources were more likely to have negative vaccine intention. Other studies have similarly found that physicians were a trusted source of health information

and can encourage COVID-19 vaccine uptake (34–36, 45). Family and friends can also be important sources of information, although if misinformed, can perpetuate myths and untruths (46, 47).

Before discussing the implications of our findings, it is important to acknowledge limitations. We analyzed data from a convenience sample of adult women and the survey was conducted as part of a larger study on Brazilian women's health experiences. As a result, the results may not be generalizable since those willing to complete health surveys may be more receptive to health interventions (48). Also, this is a cross-sectional analysis, so temporal relationships between vaccine intentions and independent variables cannot be inferred. We collected this data before any COVID-19 vaccines were available, and there was no information available about vaccine characteristics (e.g., efficacy, number of doses), which may influence vaccine intentions. More research on current vaccine intentions in the Brazilian immigrant community will likely be necessary to update and validate our findings, especially as the vaccine rollout continues.

Regardless, as the first study of COVID-19 vaccine intention among Brazilian immigrants in the U.S., our results can help to inform strategies to promote vaccination. While our findings suggest that many Brazilian women will be amenable to taking the COVID-19 vaccine, about a third were either unsure or stated they would not be vaccinated. To reach those who were unsure or who stated they would not be vaccinated, the serious nature of the pandemic should be stressed in ways that avoids causing undue stress or panic. Vaccine messaging by healthcare providers may be effective with this population, and the strong impact of provider recommendation has been documented in numerous studies (49). Specifically, studies of other vaccine types found that presumptive language, which presents vaccine uptake as the default option (e.g., "We are going to administer your vaccine today"), is more effective than conversational language that actively questions the patient about their willingness to be vaccinated (50). However, many Brazilians do not have a primary source of healthcare and lack health insurance (12). An alternative model, also supported by findings in this study, is the dissemination of information through social networks. For example, the use of community health workers to provide vaccine information has been recommended by the World Health Organization and others (51, 52), and this model has been successfully employed in the U.S. (53). In our prior research, we found that many Brazilians have strong family/friend ties and that these communication networks are strong (54), which suggests promise for this intervention model.

Conclusions

Our findings indicate that most women are amenable to taking the COVID-19 vaccine. However, to maximize the full benefits of vaccination among this community, it will still be necessary to make concerted efforts to reach those who are unsure or opposed to taking the vaccine and should stress the severity of the COVID-19 pandemic and target Brazilian immigrants who have lived a long time in the United States. Healthcare providers may be particularly suited to deliver this information given high levels of trust. Social media and local cultural media outlets may also help to ensure that people have

information about the vaccine. These findings are especially important as few studies have yet to examine COVID-19 vaccine intention among immigrant communities in the United States.

Declarations

Ethics Approval and Consent to Participate:

All protocols and procedures were approved by the Institutional Review Board at Tufts University, Medford, Massachusetts. All study participants provided informed consent.

Consent for Publication

Not Applicable

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of Competing Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article

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Authors' Contributions:

All authors made substantial contributions to the interpretation of data and have drafted the work or substantively revised it. All authors have approved the submitted version and agree both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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