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COVID-19 Vaccination Acceptance: A Case of Interplay Between Political and Health Dimensions

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Vaccines are essential for the eradication of diseases. Yet for many reasons, individuals do not embrace them completely. In the COVID-19 pandemic and with the possibility of the Brazilian population's immunization against the disease, both political and health-related dimensions might have had a role in individual COVID-19 vaccination acceptance. In two studies (n = 974), we tested the hypothesis that participants' vaccination acceptance is related to their past vote in the 2018 Brazilian presidential election (being or not being a Jair Bolsonaro voter) and their different levels of perceived vulnerability to disease (PVD). We further tested whether Bolsonaro's opposition or ambiguous messages towards vaccination (vs. control) increased vaccination rejection among those who have (vs. have not) voted for him and who are low (vs. high) in PVD. Results show that Bolsonaro (vs. non-Bolsonaro) voters accepted less vaccination, with higher rejection rates when participants expressed low (vs. high) PVD. Also, when primed either with Bolsonaro's opposed or ambiguous messages towards COVID-19 vaccination, such participants accepted less vaccines (vs. participants primed with neutral information). These findings are the first to show that the COVID-19 vaccine acceptance is related to their past vote and leadership influence but also different levels of perceived vulnerability to disease.

KEY WORDS: COVID-19 vaccination, leadership influence, perceived vulnerability to disease

Vaccines are indispensable instruments for the eradication of diseases, having long-lasting effects on the health of populations and on economic growth (Andre et al., 2008). From the onset of the COVID-19 pandemic, there has been an unprecedented race towards the development and distribution of vaccines (Petersen et al., 2021). However, there were more obstacles to this global goal than just medical and logistical ones. Vaccine hesitancy and vaccine refusal became a political-positioning issue that reached significant proportions of the population worldwide, with a recent meta-analysis describing values from 10% to 58% and from 0% to 24%, respectively (Biswas et al., 2021). This has had an impact on the number of new cases, as well as its hospitalization and mortality outcomes, presenting a significant threat to public health (Loomba et al., 2021).

A variety of reasons for antivaccination has been reported in the literature. Some refer to a lack of awareness about the need for inoculation, lower risk perception of getting a disease, or even distrust in government sources (WHO, 2020; Yaqub et al., 2014). Within this framework, many governments' strategies aimed to promote the uptake of COVID-19 vaccines by emphasizing their safety and efficacy (Shih et al., 2021; WHO, 2021). In Brazil, the scenario is quite different. According to international media, the country has been considered the worst in dealing with the disease (BBC, 2021; Forbes, 2021; New York Times, 2021; The Guardian, 2021). One of the main reasons for this might spring from the government's response to COVID-19, which has supported inefficient early treatments (e.g., the use of chloroquine) or expressed opposition or ambiguous messages to the COVID-19 vaccination (Carvalho, 2021). In this research, we investigate COVID-19 vaccine acceptance in Brazil in function of (1) the past vote, that is, if the participant voted for the incumbent president in the last election (i.e., Jair Bolsonaro) and (2) the individual perceived vulnerability to disease (PVD). Furthermore, we explore whether COVID-19 vaccine acceptance is also influenced by Bolsonaro's opposed, as well as ambiguous, endorsements towards COVID-19 vaccination.

PAST VOTE AND COVID-19 VACCINATION ACCEPTANCE

In line with the skepticism towards climate change, antivaccine rhetoric has gained popularity in the context of right-wing populism in Europe and North America (Rodríguez-Blanco et al., 2021; Speed & Mannion, 2020; Żuk & Żuk, 2020). Surveys have also found a weak but reliable trend that people are more hesitant about vaccination the more conservative their political ideology is (Baumgaertner et al., 2018; Hornsey et al., 2018; Sarathchandra et al., 2018). Some politically conservative orientations, particularly social dominance orientation (SDO), have been associated with less support for coping with the COVID-19 pandemics and lower health compliance behaviors in general (Choma et al., 2021). For example, several studies in the United States have found that the conservative ideology or the Republican Party identity is associated with various forms of vaccine skepticism (Baumgaertner et al., 2018; Featherstone et al., 2019). Likewise, this also occurs specifically in relation to COVID-19 vaccines (Hornsey et al., 2018; Shih et al., 2021). Nonetheless, individuals' ideological background affects vaccination uptake differently depending on their geographic focus. For example, Ward et al. (2020) have shown that self-identified French citizens from the far-right as well as far-left parties reject COVID-19 vaccines. Engin and Vezzoni (2020), otherwise, found no influence of political conservatism on vaccination opposition in Italy.

Brazil, featured by an extremist political environment (Calvo & Ventura, 2020; Melo & Figueiredo, 2021), provides a unique context to investigate whether political positioning has influenced the popular acceptance of COVID-19 vaccination (Xavier et al., 2022). However,

there is a specificity of Brazilians' voting behavior in function of their political orientation. Consistent students have described that their self-declared political ideology generally does not consistently overlap with their political positioning in the classical political dimensions as left–right spectrum, that is, Brazilians tend not to base their voting behavior on the political orientation they indicate they have (Ames & Smith, 2010; Braga & Pimentel, 2011; Oliveira & Turgeon, 2015). This means that the Brazilian election is guided by other multilayered and interrelated political dimensions that emerge at the specific moment of each election. That is, focusing on one dimension of political identity to predict and comprehend the voting outcomes is bound to obscure other contextual emerging aspects, which is the source of the confounding effect. For this reason, the use of behavior (Ajzen & Cote, 2008) in past elections (i.e., voting) certainly provides a more reliable and pragmatic measure of Brazilians' political positioning and is also unique in assessing the leader's role in influencing social attitudes such as vaccination acceptance.

Recent data analyzing the relationship between past vote and COVID-19 outcomes in Brazil revealed that areas with a higher percentage of votes for the incumbent president also have higher incidences of COVID-19 new cases and deaths (Hallal, 2021). Specifically, from the 5.570 Brazilian cities, 108 where Bolsonaro had less than 10% of the votes, the number of new cases and deaths was 3,781 per 100,000 inhabitants. This quantity linearly grows until achieving 11,477 cases per 100,000 habitants in the cities where Bolsonaro won the election with 80%, 90%, or more of the votes (Hallal, 2021; Xavier et al., 2022). Within this context, we hypothesize that the past vote in the 2018 presidential election (having voted or not for Bolsonaro) affects the population's willingness to accept the COVID-19 vaccination. Specifically, we predict that citizens who voted for Bolsonaro in the past election would be less willing to be vaccinated than non-Bolsonaro voters.

Perceived Vulnerability to Disease and COVID-19 Vaccination Acceptance

Individuals perceive susceptibility to pathogens and diseases differently, and many of them believe to have a lower risk of getting infectious diseases than the average of the population (Meszaros et al., 1996). In general, perceived vulnerability to disease (PVD) is related to personal beliefs about infectiousness and negative emotions caused by perceptions of susceptibility to infectious diseases or germ transmission (Duncan et al., 2009; Schaller & Duncan, 2007). It is therefore an essential construct for understanding social behaviors that facilitate infectious disease transmission (Duncan et al., 2009; Park et al., 2013). Previous research has operationalized PVD as a trait (Hromatko et al., 2021) and found it to have high temporal stability (Díaz et al., 2016). Moreover, this construct is a proxy for measuring the behavioral immune system (BIS). BIS is characterized as a set of affective, cognitive, and behavioral processes that are thought to help all species navigate their environment in ways that reduce the risk of contracting pathogens and diseases (Anderson & Zebrowitz, 2020; Hromatko et al., 2021). Although this mechanism is often automatically driven, it triggers prophylactic behaviors that involve rational and conscious decisions (e.g., vaccinating against disease) (Schaller, 2016). Previous studies have found a link between BIS and political conservatism (Green et al., 2010; Terrizzi et al., 2013). In this sense, BIS, assessed by the PVD questionnaire, aligns with the moral values and objectives of political conservatism (Green et al., 2010; Jost et al., 2009; Terrizzi et al., 2013).

At the COVID-19 pandemic onset, Benton et al. (2020) showed that COVID-19 was treated with significant partisan differences, which may have influenced its risk perceptions.

For example, a survey conducted in the U.S. context showed that political differences were the most consistent factor that differentiated health behaviors among participants (Gadarian et al., 2020). Results indicated that Democrats (compared to Republicans) were more likely to support social-distancing measures and that Republicans were less likely than Democrats to adopt the recommended preventive behaviors and be concerned with the pandemic. A study conducted in Brazil showed that, at the beginning of the pandemic, right-wing political supporters and evangelical protestants had lower levels of PVD and were less concerned about getting COVID-19 (Alexandre et al., 2020). Also, a study by Shook et al. (2020) showed that perceived vulnerability to the disease was related to stronger preventive behaviors against COVID-19. Given that BIS activates prophylactic health behaviors (Schaller, 2016), as well as the fact that the literature has consistently shown a negative correlation between this construct and conservatism (for a review, see Terrizzi et al., 2013), we expected that PVD would be a moderator of the relationship between past vote and acceptance of COVID-19 vaccination, such that the impact of having voted for Bolsonaro is especially detrimental of vaccine acceptance when citizens have lower levels of PVD.

Situational Political Influence

The social identity model of leadership (Hogg, 2001) suggests that a leader can influence their followers by (1) establishing themselves as a highly prototypical member within the group (occupying the position of an "ideal" group member for others to emulate) and (2) engaging in behaviors that serve the group in particular ways, including strong internal favoritism. This model also states that the leader's influence is usually pronounced in a salient and divisive intergroup context, as is the case of Brazil during the COVID-19 pandemic, where different social groups (e.g., scientists vs. politicians) defended opposite perspectives about the vaccination against the disease. Also, it is known that in difficult and uncertain times, people turn to their leaders for guidance (Abrams et al., 2021). Leaders, however, do not always passively reflect the desires of the group but sometimes shape the values and opinions of group members (Hornsey, Lobera, et al., 2020). Given this framework, conservative leaders have been shown to contribute to the distrust of science and consequently poorer health behaviors, such as vaccination compliance (Hamilton et al., 2015).

The political leader's power over health-behaviors influence is supported by the prototypical representation of a group engaged in conflicting and polarized ideologies and struggles. This salient and highly divisive intergroup context is fertile ground for social identity processes that increase the chances of the political leadership influencing its supporters than other high-status figures (Hogg, 2001) and make people more likely to follow and share thoughts and opinions that maintain intergroup differences (Tajfel & Turner, 1986). Parker et al. (2015) note that leadership is essential for complex global problems such as the COVID-19 pandemic, where solutions may require collective action. Leadership, however, has the potential to not only unite but also divide public opinion on issues such as vaccine acceptance. In the face of the pandemic, leaders may exploit uncertainty or even ridicule important social issues (i.e., political cynicism) to gain credibility, power, or influence for their groups, fueling polarization and extremism (Abrams et al., 2021; Fieschi & Heywood, 2004). Experiments on the persuasiveness of political leaders suggest that leaders do not persuade, but their endorsements polarize. Furthermore, politicians, rather than parties, are believed to act as polarizing cues to opinions (Kousser & Tranter, 2018; Nicholson, 2012). As for political cynicism, specifically, this was one of the political strategies of radical-right populist movements around the world (see Fieschi & Heywood, 2004) (such as "Trumpism" and

"Bolsonarism"), employing, for instance, controversial and polemical statements to mock politics and institutions and denying the gravity of and simplifying such a complex phenomenon as the COVID-19 pandemic.

In the American context, experimental research by Hornsey, Finlayson et al., 2020 investigated the extent to which loyalty to Donald Trump is associated with perceptions of COVID-19 vaccine safety and efficacy. In line with the social identity model of leadership, the results indicated an increase in concern regarding the vaccine, but only among Trump voters who were exposed to antivaccination tweets. Another experiment by Bokemper et al. (2020) showed that an announcement of the approval of a COVID-19 vaccine accompanied by a positive (vs. negative) endorsement of President Trump regarding the vaccine considerably reduced beliefs about its safety and efficacy and willingness to get it among Democrats and increased among Republicans. Despite the significance of these findings demonstrating the relationship between ideological positions and the leader's influence on the vaccination phenomenon, they fail to account for the fact that individual differences in attitudes towards diseases may play an important role in this relationship. The current study aims to fill this gap by testing whether those who are more influenced by their leaders not to get vaccinated have lower perceptions of disease vulnerability.

With this in mind, we hypothesize that the acceptability of COVID-19 vaccines is not static. That is, if a revered and prototypical ingroup member (e.g., President Bolsonaro for who has voted for him) holds opposing or ambiguous positions on vaccines, this may reduce vaccine acceptance among those who voted for him, but only in those who have low PVD expression. Moreover, we reason those ambiguous statements, in particular, can have the same persuasive effect as opposing arguments when combined with additional peripheral cues (i.e., Bolsonaro figure that at first was against the COVID-19 vaccination) (Chaiken & Maheswaran, 1994). Thus, we argue that following leader instructions might serve as a heuristic for individuals' vaccination decision-making.

Overview of the Present Research

In this research, we test the hypothesis that individuals who have (vs. have not) voted for Bolsonaro in the 2018 Brazilian presidential election would stymie the acceptance of COVID-19 vaccination. Moreover, we predict that individual and contextual variables such as the PVD and leadership endorsements (Bolsonaro's opposed or ambiguous messages towards vaccination) would predict Brazilians' COVID-19 vaccination refusal. Specifically, in Study 1, we test whether the past vote and individual differences in PVD are related to COVID-19 vaccination acceptance.

H1: We predict that individuals who voted for Bolsonaro in the 2018 Brazilian presidential election would be less likely to accept COVID-19 vaccines if they expressed low (vs. high) levels of PVD.

In Study 2, we went further by using a different approach to studying the influence of political variables, focusing on situational persuasive information by the president. In particular, we exposed participants to the influence of Bolsonaro's opposition messages or ambiguous endorsements of COVID-19 vaccines (compared to neutral information). In line with Hypothesis 1,

H2: We expect that when primed with Bolsonaro's either opposed or ambivalent messages towards COVID-19 vaccination, Bolsonaro voters with low PVD would be less willing to accept the disease's immunization than participants primed with neutral information.

The procedures used in these studies were approved by a research ethics committee and met all APA ethical principles. The datasets used can be accessed on the OSF repository platform at https://osf.io/54gxv/.

STUDY 1

In Study 1, we explore the relation between the past vote in the 2018 Brazilian presidential election, PVD, and COVID-19 vaccination acceptance. We hypothesized that Bolsonaro voters would accept less COVID-19 vaccination when they are low (vs. high) in PVD, with this association being particularly strong if the COVID-19 vaccine is CoronaVac (vs. other types of vaccines). Among vaccine types, we highlight CoronaVac because this vaccine is particularly relevant to the context of Brazil and has consistently received opposed or ambiguous endorsements to its intake from Jair Bolsonaro since its announcement of availability in Brazil. CoronaVac was developed by the Chinese laboratory Sinovac in collaboration with the Brazilian vaccination center Butantan in the state of São Paulo. The governor of this state, João Doria, led the national campaign and lobbied Brazilian politics for the development of such a vaccine, competing with Bolsonaro, who initially opposed any vaccination, mainly on the grounds that COVID-19 was "just a little Chinese flu" (Pontalti Monari & Sacramento, 2021). Only further on, and in response to the sharp decline in his popularity for opposing measures to combat the pandemic, did Bolsonaro change his speech and begin to promote vaccination, albeit in an ambivalent way, especially with regard to CoronaVac. Therefore, this is a particular and unique context to examine the relationship between political attitudes, PVD, and vaccination.

Method

Participants

Two hundred ninety-four Brazilian citizens were invited to take part in this study. Their ages ranged from 18 to 83 years (67.3% female, Age: $M = 32.6$; $SD = 12.81$). Participants were mostly White (54.4%), Brazil's northeast residents (65.6%), and had higher education degrees (51.4%). In terms of religion, the majority self-declared as Catholics (33.7%) and nonpracticing (29.9%). It is a convenience sample (nonprobabilistic), with the participation of those who, voluntarily, agreed to collaborate with the research. Sensitivity analyses revealed that this sample (61 Bolsonaro voters; 233 non-Bolsonaro voters) is powered to detect an effect size $d = .23$ or higher with $\alpha = .05$ and $\beta = .80$.

Procedures and Materials

Data was collected online using the Qualtrics software through social media platforms, such as Facebook and Instagram. Participants were asked to read and accept the informed consent form if they agreed to be engaged in the study. Since voting is mandatory in Brazil, inclusion criteria were being Brazilian and older than 18 years. Participation in the study was voluntary, anonymous, and confidential. No reward was assigned as an incentive to participate. Data collection occurred from February 5 to February 15 of 2021 (two weeks after the first COVID-19 vaccination in Brazil). After consenting, participants answered the following measures.

Perceived Vulnerability to Disease

We used a self-report instrument (i.e., PVD-br) validated in Brazil by Do Bú et al. (2021) to assess participants' individual differences in chronic concerns on the susceptibility to get infectious diseases and aversion to germs. The measure is composed of 15 items answered on a 7-point scale (1 = *Strongly Disagree*; 7 = *Strongly Agree*). In this study, the PVD's internal consistency was $\alpha = .716$.

Past Vote in the Presidential Election

To access the past vote in Brazil's 2018 presidential election, we asked participants: "In the last elections for the president of Brazil, did you vote for the current president Jair Bolsonaro?" (−.5 = no; .5 = yes).

COVID-19 Vaccination Acceptance

We measured the COVID-19 vaccination acceptance through five questions. The first question was: "What is the probability of you getting vaccinated against COVID-19 when a vaccine become available?" The following four questions repeated the first one but specified four common vaccines in the Brazilian scenario at the data-collection moment (CoronaVac, AstraZeneca, Pfizer, and Sputnik-V). In this way, we measured participants' COVID-19 vaccination acceptance in general without a specific type of vaccine and also with specific ones. Participants answered on 5-point rating scales, ranging from 1(*Not likely*) to 5 (*Very likely*).

Sociodemographic

Participants were asked to provide their age, gender, education level, skin color, and family income. Also, we asked participants' religion and their level of religiosity (i.e., "To what extent do you consider yourself religious?" 0 = *not at all*; 5 = *totally*). The analyses reported below were conducted both with and without control for the seven sociodemographic variables. Given that the pattern of results is maintained with and without the control variables, we present the results while controlling for them.

Results

Initially, we analyzed the correlations between the measured variables. Both the past vote in the presidential election and PVD were moderate to weakly related to vaccination acceptance (see the online supporting information). Specifically, being a Bolsonaro voter was negatively correlated with vaccination acceptance, especially with the CoronaVac vaccine. Fisher's *r*-to-*Z* transformation (Eid et al., 2011) showed that the past vote in the presidential election correlated significantly more strongly with CoronaVac acceptance ($r = .44$; $p = .001$) than with COVID-19 vaccination acceptance without a specific type of vaccine ($r = .28$; $p = .001$) ($Z = 2.39$; $p = .008$). Also, PVD was negatively related to the past vote, indicating lower PVD expression among Bolsonaro voters. In fact, the averages for each group (Bolsonaro vs. non-Bolsonaro voters) were significantly different for all types of vaccine acceptance and for PVD (see Table 1). As predicted, Bolsonaro voters had lower COVID-19 vaccination acceptance and PVD expression than non-Bolsonaro voters. The effect size of the vote difference was higher for the CoronaVac vaccine than for the acceptance of other vaccines.

Table 1. Comparisons Between Bolsonaro and Non-Bolsonaro Voters on Acceptance of COVID-19 Vaccination and Perceived Vulnerability to Diseases

	Bolsonaro Voters (n = 61)	Non-Bolsonaro Voters (n = 233)	
Variables	*M* (*SD*)	*M* (*SD*)	Effect size (*d*)
COVID-19 vaccination	4.38 (1.41)	4.96 (.52)	.74
CoronaVac	3.43 (1.77)	4.75 (.80)	1.23
AstraZeneca	3.95 (1.41)	4.72 (.79)	.81
Pfizer	3.58 (1.57)	4.58 (.96)	.90
Sputnik-V	3.42 (1.61)	4.46 (1.07)	.87
PVD	4.34 (.85)	4.62 (.74)	.37

Note: All means between Bolsonaro and non-Bolsonaro voters are significantly different at p = .05.

Table 2. Predictors of COVID-19 Vaccination and CoronaVac Vaccine Acceptance

				95% CI	
	b	*SE*	*p*	Lower	Upper
Vaccination acceptance					
Past vote	−.63	.11	<.001	−.86	−.39
PVD	.19	.06	.005	.06	.33
Past vote * PVD	.40	.13	.004	.13	.67
Age	.001	.003	.868	−.006	.008
Gender	−.14	.09	.147	−.33	.05
Education level	.23	.07	.002	.09	.38
Skin color	−.02	.03	.567	−.09	.05
Family income	.002	.02	.940	−.05	.06
Level of religiosity	−.02	.01	.156	−.05	.008
CoronaVac vaccine acceptance					
Past vote	−1.10	.14	<.001	−1.39	−.81
PVD	.36	.08	<.001	.18	.53
Past vote * PVD	.68	.17	<.001	.34	1.03
Age	−.001	.004	.723	−.01	.007
Gender	−.02	.12	.858	−.26	.22
Education level	.25	.09	.009	.06	.43
Skin color	−.001	.04	.993	−.09	.09
Family income	.04	.03	.201	−.02	.12
Level of religiosity	−.01	.01	.324	−.05	.01

Note: Reported values correspond to the regression step denoted in the left-hand column. All sociodemographic variables were controlled in this model. Past vote (−.5 = non-Bolsonaro voters; .5 = Bolsonaro voters).

To explore the potential psychological mechanisms underlying the COVID-19 vaccination acceptance, and, specifically, CoronaVac vaccine acceptance, we estimated regression models with the criterion variables being the general COVID-19 vaccination acceptance (i.e., variable that measured vaccination acceptance in general, without a specific target vaccine) and the CoronaVac vaccine acceptance. To test our prediction, we examined the effect of past vote in the last presidential election, the PVD, and the interaction between these two variables. Also, we controlled for participants' sociodemographic characteristics (i.e., age, gender, education level, skin color, family income, and level of religiosity). Results are summarized in Table 2.

As predicted, results showed a reliable main effect of vote confirming that participants' who voted for Bolsonaro accepted less the COVID-19 vaccination in general and the CoronaVac vaccine. The associations of PVD with the vaccination acceptance in general and CoronaVac acceptance were also significant. Importantly, we found a significant interaction between past vote and PVD for both vaccination acceptance measures, which suggests the vote difference in vaccine acceptance was moderated by PVD. In fact, simple slope indicated that the effect of past vote on COVID-19 vaccination acceptance was stronger in participants low in PVD (−1SD; $b = -1.02$; $SE = .14$; $p < .001$; 95% CI = −.1.31; −.74) than in people high in PVD (+1SD; $b = -0.36$; $SE = .17$; $p = .040$; 95% CI = −.71; .02). Furthermore, in participants with low PVD expression, the effect of past vote on CoronaVac vaccine acceptance was also stronger ($b = -1.68$; $SE = 0.18$; $p < .001$; 95% CI = −2.05; −1.32) than in people with high PVD ($b = -0.64$; $SE = 0.22$; $p = .004$; 95% CI = −1.08; −.21). These findings are in line with our hypothesis, indicating that Bolsonaro (vs. non-Bolsonaro) voters were less willing to accept COVID-19 vaccination and CoronaVac vaccine, and such acceptance is reduced when they are low in PVD, as shown in Figure 1.

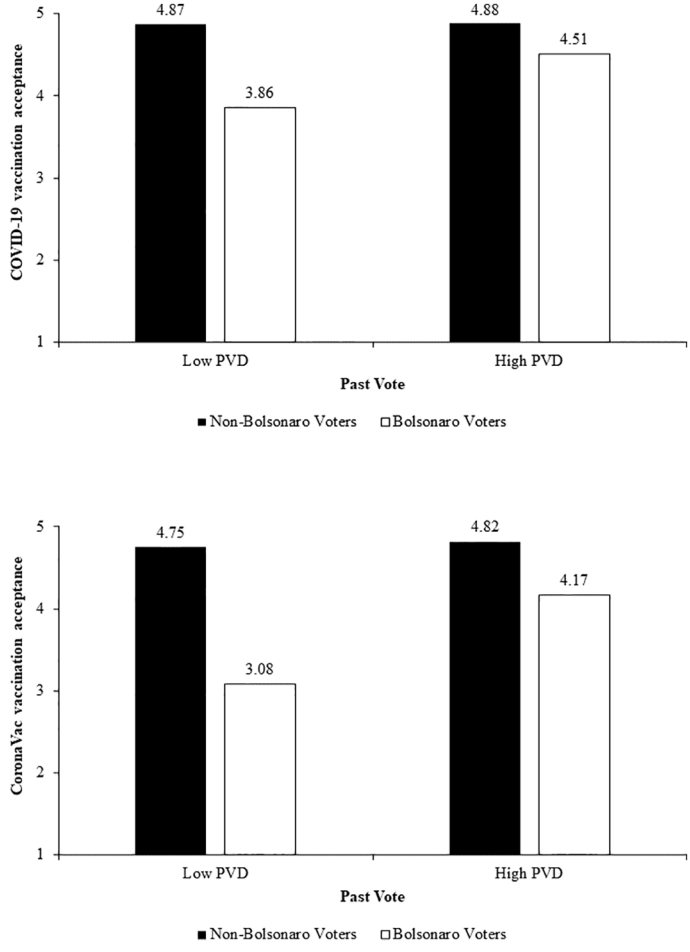


Figure 1. Past vote effect on COVID-19 vaccination and CoronaVac vaccine acceptance with different levels of PVD (low vs. high).

Discussion

Results indicated that the past vote in Brazil's 2018 presidential election is related to PVD and COVID-19 vaccination acceptance. Specifically, we found that Bolsonaro voters (vs. non-Bolsonaro voters) were less likely to accept COVID-19 vaccines, especially CoronaVac. Such acceptance is even lower when these participants are low (vs. high) in PVD. These findings are in line with previous research that shows that the lower the PVD, the less preventive health behaviors are (Schaller, 2016), such effects being correlated with political positioning (Terrizzi et al., 2013). Moreover, besides confirming the previous pattern of findings showing a relationship between support for Bolsonaro in the last presidential election and COVID-19 outcomes (Xavier et al., 2022), the results from this study also showed that this phenomenon extends to vaccination uptake against the disease, which may amplify its spread and mortality rates. However, although this work shows that the past vote in Brazil's 2018 presidential election was related to COVID-19 vaccination acceptance, the study's correlational nature does not allow us to verify whether Bolsonaro's speech on the current pandemic concerning the vaccination of COVID-19 may or may not impact COVID-19 vaccination adherence in general, or with the CoronaVac vaccine, for example. Thus, it is critical that subsequent work test whether the past vote as well as Bolsonaro's political speech and endorsing opposing or ambiguous arguments against the COVID-19 vaccination have a causal effect on the proposed relationships. We experimentally addressed such issues in Study 2.

STUDY 2

Since the announcement of the possibility of COVID-19 vaccination in 2021, Brazilians have been confronted with Bolsonaro's endorsements, which range from an outright rejection of COVID-19 vaccination to an ambiguous position in which it is unclear whether he is completely in favor or against it. In this study, besides aiming to replicate the pattern of results found in Study 1, we also tested the hypothesis that both contrary and ambiguous Bolsonaro's endorsements about COVID-19 vaccination (vs. neutral information) would reduce vaccination acceptance of those who have (vs. have not) voted for him and who are low (vs. high) in PVD. As in the previous study, we expected these associations to be particularly strong with respect to the CoronaVac vaccine.

Method

Participants

The planned sample size was a minimum of 576 to achieve 80% of chance of detecting a small effect (f = .15) when comparing three experimental groups (Zhang & Yuan, 2018). Eight hundred and thirty-three Brazilian citizens were invited to take part in this research on COVID-19 vaccination. However, 153 participants were not eligible because they did not reach the end of the questionnaire. The final sample constituted 680 participants. Their ages ranged from 18 to 72 years (M = 29.8; SD = 11.87); they were predominantly female (68.7%), with White skin color (49.1%), had undergraduate degrees (60.9%), and were Brazilian northeast residents (84.5%). This is a nonprobabilistic sample, with the participation of those who voluntarily agreed to collaborate with the research.

Study Design

The independent variable was the past vote in Brazil's 2018 presidential election (being or not a Bolsonaro voter). The dependent variable was COVID-19 vaccination acceptance (vaccination towards COVID-19 with no specification of a vaccine's type and vaccination with the CoronaVac vaccine). The moderators were the individual differences in PVD and the manipulated salience of Bolsonaro's positioning about vaccination. Participants were randomly assigned to one of three conditions in a one-way between-subjects experimental design: Bolsonaro's contrary versus Bolsonaro's ambiguous opinions towards COVID-19 vaccination versus Control.

Procedures and Materials

Data-collection procedures were replicated from Study 1. However, after consenting to take part in the study, participants were randomly allocated to one of three experimental conditions: contrary messages of President Bolsonaro towards COVID-19 vaccination (n = 221: 168 non-Bolsonaro vs. 53 Bolsonaro voters), ambiguous messages of President Bolsonaro towards COVID-19 vaccination (n = 228: 172 non-Bolsonaro vs. 56 Bolsonaro voters), and a control group (n = 225: 175 non-Bolsonaro vs. 50 Bolsonaro voters). At the beginning of the questionnaire, participants were primed with different tweets. In the two experimental conditions, participants read tweets by Bolsonaro expressing either his opposition or his ambiguous opinion towards the COVID-19 vaccination. In the control condition, participants read tweets with weather forecast predictions with no mention of Bolsonaro. We used tweet messages in operationalizing Bolsonaro's political influence following previous studies developed in the United States in the pandemic context (i.e., such studies used Trump's tweet messages as indicators of political leadership influence on COVID-19 vaccine acceptance) (Hornsey et al., 2020). In general, leadership is posited by the position of the person who posted the tweets (i.e., the President of the Republic). Tweets are available in the online supporting information. They were pretested regarding their veracity and clarity as well as contrary, ambiguous, or neutral dimensions. After reading the tweets, participants answered the set of measures used in Study 1. Data were collected from February 24 until March 15 of 2021 (one month after the first COVID-19 vaccination in Brazil).

Perceived Vulnerability to Disease

We used the PVD-br to measure our participants' perceived vulnerability to disease as in the previous study. Its total internal consistency for this study was α = .73.

COVID-19 Vaccination Acceptance

The tendency to accept COVID-19 vaccination was measured using two of the same questions from Study 1: the general item accessing overall COVID-19 vaccination acceptance without a specific target vaccine and the item of acceptance of CoronaVac.

Past vote in Brazil's 2018 presidential election and participants' sociodemographic data were accessed through the same questions as in Study 1.

Results

Comparisons Between Experimental Conditions and Past Vote on COVID-19 Vaccination Acceptance

ANOVA results showed a marginally significant effect of the experimental conditions on COVID-19 vaccination acceptance [$F(2, 668) = 2.98$; $p = .051$; $\eta_p^2 = .009$]. Simple effects showed significant differences between the contrary ($M = 4.52$; $SD = 1.08$) ($b = .24$; $SE = .10$; $p = .028$; $d = .24$), ambiguous ($M = 4.52$; $SD = 1.07$) ($b = .22$; $SE = .10$; $p = .042$; $d = .17$), and control conditions ($M = 4.68$; $SD = .86$). However, no differences were found between the contrary and ambiguous conditions ($b = -.02$; $SE = .10$; $p = .843$; $d = .01$). The main effect of the past vote was significant [$F(1, 668) = 63.96$; $p = .001$; $\eta_p^2 = .087$]. Bolsonaro voters were less willing to accept COVID-19 vaccination ($M = 4.03$; $SD = 1.42$) compared to non-Bolsonaro voters ($M = 4.74$; $SD = 0.77$). Moreover, Bolsonaro voters accepted less COVID-19 vaccination in the contrary ($M = 3.88$; $SD = 1.51$) ($b = .41$; $SE = .19$; $p = .031$, $d = .30$), as well as in the ambiguous conditions ($M = 3.92$; $SD = 1.45$) ($b = .37$; $SE = .18$; $p = .05$; $d = .28$) when compared to the control one ($M = 4.30$; $SD = 1.29$). Yet no differences were observed concerning the contrary and ambiguous conditions ($b = -.01$; $SE = .20$; $p = .945$; $d = .01$). Concerning the non-Bolsonaro voters, no statistically differences were found between the contrary ($b = -.02$; $SE = .11$; $p = .858$; $d = -.01$), ambiguous, and control conditions ($b = -.05$; $SE = .11$; $p = .621$; $d = -.05$). Despite this different pattern in Bolsonaro's speech manipulation effect on his voters (vs. nonvoters), the interaction between experimental manipulation and the past vote was nonsignificant [$F(2, 668) = 1.49$; $p = .226$; $\eta_p^2 = .004$].

Regarding the CoronaVac vaccine acceptance, we found a nonsignificant effect of the experimental conditions [$F(2, 667) = 2.31$; $p = .100$; $\eta_p^2 = .007$]. However, the main effect of the past vote was significant [$F(1, 667) = 124{,}36$; $p = .001$; $\eta_p^2 = .157$]. As predicted, Bolsonaro voters were less willing to get the CoronaVac vaccine ($M = 3.55$; $SD = 1.64$) than non-Bolsonaro voters ($M = 4.67$; $SD = 0.84$). More importantly, ANOVA results also showed a condition × past vote interaction, $F(2, 667) = 3.16$; $p = .043$; $\eta_p^2 = .009$. Sample effects showed that Bolsonaro voters were less willing to accept the CoronaVac vaccine in the contrary ($M = 3.39$; $SD = 1.70$) ($b = .50$; $SE = .21$; $p = .020$, $d = .31$) and ambiguous conditions ($M = 3.41$; $SD = 1.68$) ($b = .48$; $SE = .21$; $p = .022$; $d = .30$) when compared to the control one ($M = 3.89$; $SD = 1.53$). However, no differences were observed concerning the contrary and ambiguous conditions ($b = -.01$; $SE = .20$; $p = .945$; $d = .01$). Concerning the non-Bolsonaro voters, no statistical differences were found between the messages: contrary vs. control ($b = -.05$; $SE = .11$; $p = .621$; $d = -.05$); ambiguous vs. control ($b = -.02$; $SE = .11$; $p = .858$; $d = -.01$); contrary vs. ambiguous ($b = -.02$; $SE = .11$; $p = .858$; $d = -.01$).

Comparisons Between Perceived Vulnerability to Diseases and Past Vote on COVID-19 Vaccination Acceptance

Mirroring results from Study 1, moderation analyses revealed that, depending on the PVD level (low vs. high), past presidential vote predicted COVID-19 vaccination acceptance (interaction: $b = .41$; $SE = .09$; $p = .001$) and CoronaVac vaccine acceptance (interaction: $b = 0.46$; $SE = .11$; $p = .001$). Decomposing the interactions, we found that in people low in PVD, the effect of past vote in Bolsonaro on COVID-19 vaccination acceptance was stronger ($b = -.92$;

SE = .10; *p* = .001; 95% CI = −1.13; −.71) than in people high in PVD (*b* = −.24; *SE* = .13; *p* = .071; 95% CI = −1.80; .07). Similarly, in people with low PVD expression, the effect of voting for Bolsonaro on CoronaVac vaccine acceptance was stronger (*b* = −1.36; *SE* = 0.12; *p* = .001; 95% CI = −1.60; −1.12) than in those with high PVD (*b* = −0.60; *SE* = 0.15; *p* = .001; 95% CI = −.90; −.30). That is, there was a lower acceptance to the vaccine among Bolsonaro voters, and this acceptance was reduced when they were low in PVD.

Comparisons Between Past Vote, Experimental Conditions, and Perceived Vulnerability to Diseases on COVID-19 Vaccination Acceptance

Further, we performed a double moderation analysis to test the hypothesis that opposing and ambiguous (vs. neutral) Bolsonaro's endorsements against COVID-19 vaccination would reduce vaccination acceptance of those who have (vs. have not) voted for him and who are low (vs. high) in PVD. In such analysis, we had the past presidential vote as a predictor of COVID-19 vaccination and CoronaVac vaccine acceptance and, as moderators, the PVD expression and the experimental manipulation of Bolsonaro's positioning. Regarding the COVID-19 Vaccination acceptance, we observed a significant three-way interaction between past vote, experimental manipulation, and PVD, F (4, 644) = 5.68; p = .001; η_p^2 = .034. Table 3 shows simple effects of the past vote on COVID-19 Vaccination acceptance at each level of moderators.

Results showed that the past vote effect on COVID-19 vaccination acceptance was higher on the opposition and ambiguous (vs. neutral) conditions, especially in participants low (vs. high) in PVD (Figure 2). In other words, the vaccination acceptance was lower on conditions where participants read Bolsonaro's contrary and ambiguous tweets than when they read neutral messages. Such an effect particularly occurred on those who have voted for Bolsonaro in the past presidential election and are low but not high in PVD expression.

Concerning the CoronaVac vaccine acceptance, we also observed a significant three-way interaction between past vote, experimental manipulation, and PVD, F(4, 643) = 4.75; p = .001; η_p^2 = .029. The second panel of Table 3 presents simple effects of the past vote on CoronaVac vaccine acceptance at each of the moderators' levels. Results also showed that the past vote effect on CoronaVac vaccine acceptance was greater on the contrary and ambiguous (vs. neutral) conditions in participants with low (vs. high) PVD expression (Figure 3). That is, as in the COVID-19 vaccination acceptance, CoronaVac acceptance was also lower on the contrary and ambiguous conditions when compared to the neutral one, especially in those who voted for Bolsonaro in the past presidential election and are low (vs. high) in PVD.

Additionally, we broke down the three-way interaction above as described taking as reference the experimental conditions. Simple effects showed that, among Bolsonaro voters with low

Table 3. Simple Effects of the Past Vote at Moderators' Levels on COVID-19 Vaccination Adherence

Moderator Levels		Vaccination Acceptance			CoronaVac Vaccine Acceptance		
Condition	PVD	*B*	*SE*	*p*	*b*	*SE*	*P*
Control	Low	−.44	.21	.017	−.75	.21	<.001
	High	−.52	.27	.002	−.69	.27	<.001
Opposed	Low	−1.36	.22	<.001	−1.94	.22	<.001
	High	−.01	.26	.947	−.25	.26	.342
Ambiguous	Low	−1.06	.19	<.001	−1.51	.19	<.001
	High	−.13	.24	.532	−.72	.24	.003

Note: Past vote (−.5 = non-Bolsonaro voters; .5 = Bolsonaro voters).

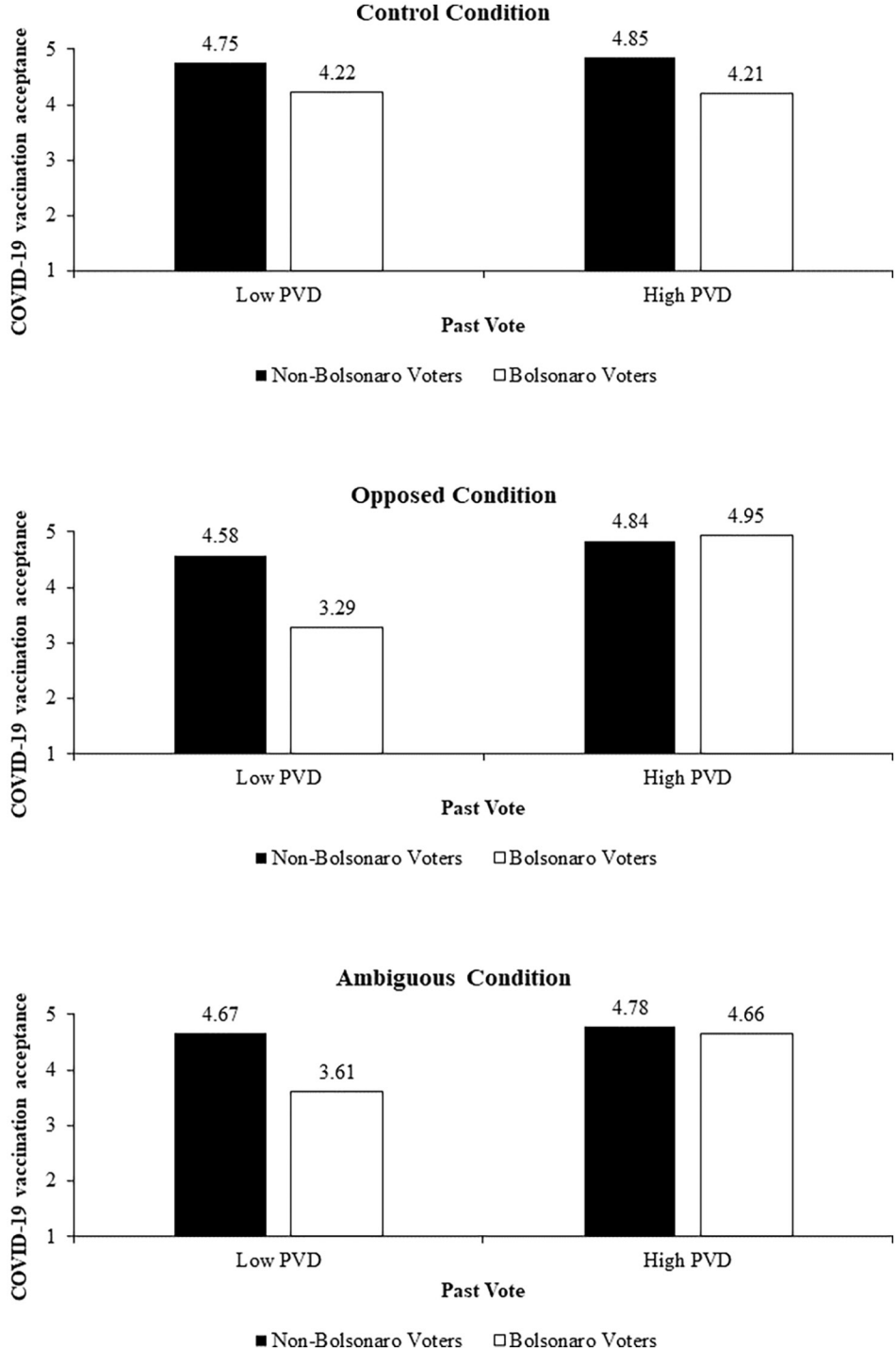
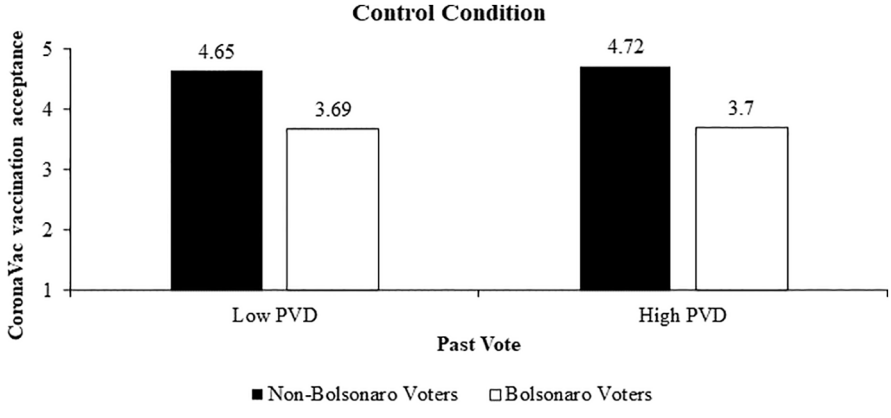
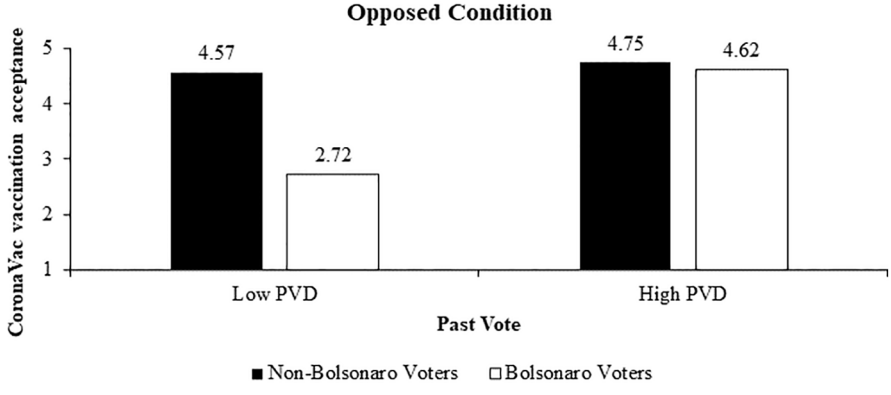


Figure 2. Past vote effect on COVID-19 Vaccination acceptance in the experimental conditions.





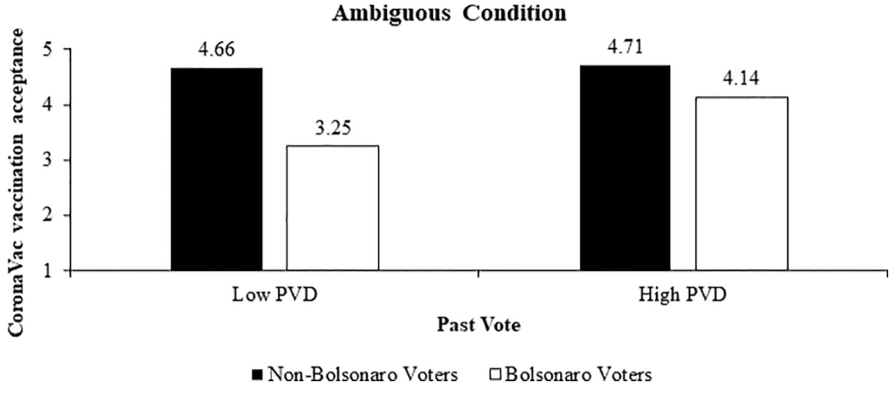


Figure 3. Past vote effect on CoronaVac Vaccine acceptance in the experimental.

PVD, there were significant differences in COVID-19 vaccination adherence and CoronaVac acceptance between the contrary and control conditions. Also, we found significant differences between the ambiguous and opposed conditions. Importantly, we identified a marginally significant effect between the ambiguous and control conditions regarding COVID-19 vaccination. That is, corroborating our hypotheses, COVID-19 vaccination adherence was higher in the control when compared to the opposed and ambiguous conditions among Bolsonaro voters. Unexpectedly, we further found higher CoronaVac adherence in the opposed condition compared to the ambiguous condition among Bolsonaro voters high in PVD. Comparisons between those who did not vote for Bolsonaro by their different PVD levels and in the different experimental conditions were not significant (see Table 4).

Discussion

Brazilians have received contradictory information about COVID-19 vaccines. While on the one hand, health organizations and professionals state that only through vaccination will cases of COVID-19 transmission and its consequences be reduced (WHO, 2021); but on the other hand, Brazil's current president, Jair Bolsonaro, supported COVID-19 early treatment (with insufficient empirical evidence of its efficacy) instead of COVID-19 vaccines, publicly endorsing opposing or ambiguous messages regarding vaccines' efficiency (Carvalho, 2021). Results from this study showed that the past vote and PVD expression but also opposing messages and ambiguous (vs. neutral) endorsements towards vaccination expressed by Bolsonaro (via Twitter) negatively influenced vaccination acceptance. Specifically, either opposing or ambiguous tweets by Bolsonaro had a negative effect on the uptake of COVID-19 vaccination for individuals who voted for Bolsonaro and are low in PVD. Thus, by focusing on the CoronaVac vaccine and the specific

Table 4. Simple Effects of the Past Vote at Moderators' Levels on COVID-19 Vaccination Adherence (experimental conditions as reference)

			Vaccination Acceptance			CoronaVac Acceptance		
Past Vote	PVD	Conditions	*B*	*SE*	*p*	*b*	*SE*	*p*
Bolsonaro Voters	Low	Opposed—Control	−.97	.24	.001	−1.01	.28	.001
		Ambiguous—Control	−.45	.23	.052	−.32	.26	.215
		Ambiguous—Opposed	.52	.23	.023	.68	.26	.008
	High	Opposed—Control	.30	.29	.314	.15	.33	.656
		Ambiguous—Control	.17	.31	.577	−.63	.35	.070
		Ambiguous—Opposed	−.47	.31	.128	−.76	.35	.025
Non-Bolsonaro Voters	Low	Opposed—Control	−.05	.15	.715	.08	.17	.635
		Ambiguous—Control	−.01	.15	.933	.13	.16	.411
		Ambiguous—Opposed	.04	.15	.776	.05	.177	.757
	High	Opposed—Control	−.03	.13	.818	.04	.15	.795
		Ambiguous—Control	−.07	.14	.571	.03	.15	.851
		Ambiguous—Opposed	−.04	.13	.729	−.01	.15	.946

content of the communication disseminated by the Brazilian leader about it, we showed that the past vote and the individual expression of the PVD are not the only factors that explain the non-acceptance of COVID-19 vaccination among Bolsonaro voters. In particular, this phenomenon is also related to the communication persuasion efforts of the head of state (Hogg, 2001).

When comparing results of Studies 1 and 2, we see that COVID-19 vaccination adherence of Bolsonaro voters (with high PVD) was 4.51 in Study 1. In Study 2, however, this average increased to 4.95, even when participants have voted for Bolsonaro, had high levels of PVD, and were primed with opposing messages of Bolsonaro towards vaccination. A similar pattern of results was identified concerning CoronaVac vaccine acceptance, which was 4.17 in Study 1, whereas it was 4.66 in Study 2. Apart from the fact that different samples were used in Studies 1 and 2, the characteristics of the latter group in particular could be an explanation for these differences. Moreover, changes in the Brazilian scenario may also explain such differences. We believe that, although the surveys took place at closely spaced times, the constant scandals involving the president in vaccine purchase negotiations, conflicting information in the media and social networks, as well as the incentive to vaccinate by health authorities, may have led Bolsonaro voters who had a low and high PVD to be more likely to accept vaccination at the time of Study 2's data collection. However, we reiterate the importance of experimental manipulation and the results of Study 2, as they show that it is only in the association of opposing and/or ambiguous messages from the president that his voters with low PVD adhere less to vaccination.

General Discussion

Despite the ample scientific evidence demonstrating the safety and efficacy of the COVID-19 vaccines, vaccine hesitancy and non-acceptance still pose a significant obstacle to ending the pandemic (Hamel et al., 2020). In two studies, we collected correlational and experimental evidence on the association between past vote in the 2018 Brazilian presidential election, PVD, and Brazilians' COVID-19 vaccination acceptance. Specifically, in Study 1, we observed that Bolsonaro voters (vs. non-Bolsonaro voters) were less likely to accept COVID-19 vaccines, especially CoronaVac, and acceptance was even lower when participants expressed low (vs. high) PVD. In Study 2, we further showed that when primed either with Bolsonaro's opposing or ambiguous messages towards COVID-19 vaccination (vs. control condition), Bolsonaro (vs. non-Bolsonaro) voters, with low (vs. high) PVD, were less accepting of the disease's immunization compared to participants primed with neutral information. In this way, Study 2 reveals, for a debate on the influence of political leaders on their followers, that the "Bolsonaro effect" is not directly reflected but may depend on people's preexisting attitudes towards diseases and their perceived vulnerability to them. Moreover, by demonstrating that opposition to vaccination among Bolsonaro voters is greater when the vaccine is CoronaVac, and considering that President Bolsonaro has been mainly opposed to the vaccine since the beginning of its use, this study shows the importance of the leading figure in shaping health prevention behaviors.

Given that, the findings described in this research article provide important evidence for furthering the debate on political influences on individuals' health behaviors. Specifically, by drawing on Hogg's (2001) model of leader influence and using vaccination acceptance or nonacceptance as an indicator of leadership influence, we empirically demonstrate how health behaviors in a pandemic environment may be related to an individual's political positioning and leadership influence. Moreover, by showing that this is the case only when perceived vulnerability to disease is low, we also demonstrate that such an effect on the acceptance or nonacceptance of a disease-preventive

behavior is not static but depends on health-related individual differences. The data presented here are concerning because they show that the previous assumptions for the Brazilian scenario have changed, as prior to the pandemics, Brazil had a greater acceptance of vaccination in the population being pointed to as a reference in the international community (Monteiro et al., 2018). Thus, our findings not only support earlier research on the impact of PVD levels on health behaviors (Hromatko et al., 2021; Schaller, 2016; Terrizzi et al., 2013), but they also advance the line of research into the impact of individual and political variables on public health behaviors.

Despite the theoretical and practical implications of this research program's findings, the studies developed have some limitations. It should be noted that, while reliable, the effect of ambiguous tweets about the vaccine on Bolsonaro's supporters was small. This may have happened because many Bolsonaro supporters have already internalized the president's negative attitude towards the vaccine, or that the primacy effect of tweets amplifies the effect from time to time and counteracts the sleeper effect (Kumkale & Albarracín, 2004). Another limitation stems from the research's nature-related problem, which is the constant influence of changing political realities. We know that prior to conducting Study 2, the president began to change his speeches, starting to defend a more ambiguous stance: sometimes remaining in favor of and sometimes opposing certain vaccines (e.g., the CoronaVac vaccine).

Additionally, despite the importance of using Brazilians' voting behavior as a proxy of their political identity (Ames & Smith, 2010; Braga & Pimentel, 2011; Oliveira & Turgeon, 2015), such a variable did not allow us to precisely distinguish between such an identity and antipolitical behaviors identified in the last presidential election in Brazil (Borges & Vidigal, 2018; Braga & Zolnerkevic, 2020). Even though we find a significant main effect of past vote on Bolsonaro on the (lack) intention to get vaccinated against COVID-19, future studies should dwell on the complexities of voting behavior in Brazil. Considering that in the past election, the negativity towards the incumbent Labour Party (*Partido dos Trabalhadores*), known as Antipetism, had a decisive role (Samuels & Zucco, 2018), we could expect a greater magnitude of the described effect in partisan voting, compared to the antipartisan or the nonpartisan voting.

Another issue is the imbalanced nature of previous vote samples. The polls drew a large number of non-Bolsonaro voters. There are a few possible explanations for that. First, because these are nonprobability samples, nonvoters may have been more interested in answering a survey about health behaviors during the pandemic. Second, disgruntled people may have indicated that they did not vote for Bolsonaro in the previous election because they were ashamed of assuming some responsibility for the adverse consequences caused by the election of Bolsonaro. Third, the uneven assessment in previous voting samples may have occurred because most of the sample lived in northeastern Brazil, where the incumbent president received fewer votes than in other parts of the country, such as the south, southeast, and mid-west. Moreover, the studies presented in this research program were conducted in early 2021, and the presidential election participants voted for took place in 2018. In this case, it is possible that some participants might regret the person they voted for, as recent data shows that 26% of the 57 million who voted for Bolsonaro are in favor of his impeachment (PoderData, 2021). In this regard, further research is needed to investigate, for example, whether the president's stances and his scientific denialism towards the pandemic were relevant reasons for his past voters with high PVD to withdraw their political support.

It is important to note that religious individuals who identify as Evangelicals have demonstrated support for Bolsonaro's government in Brazil (Sousa & Sousa, 2020). Moreover, previous studies have consistently demonstrated that this religious group is strongly conservative and has science deniers (Almeida, 2019; Souza & Chéquer, 2021). In our study, religiosity, when combined with other participants' sociodemographic variables, did not explain COVID-19 vaccination acceptance.

A similar pattern of results was also found in a study developed by Alexandre et al. (2020) regarding Brazilians' concern on getting COVID-19. In such a study, the authors found that when putting participants' religiosity together with political positioning, for example, the latter variable was a better predictor of the concern of getting COVID-19. Since delving into these relationships is beyond the scope of this article, and we use religiosity in our model as a control variable, further studies could examine more closely the role that religiosity and the different religions of Brazilians play in COVID-19 vaccination adherence. Such studies could also explore how different levels of perceived vulnerability to diseases, along with religiosity, may explain this acceptance.

Future research should investigate whether other members of the Bolsonaro administration (such as the Minister of Health) affected Brazilians' acceptance of the COVID-19 vaccine. Given that other Brazilian public personalities (such as scientists, artists, and even opposing politicians like the former president Lula da Silva) have launched vaccination campaigns, future research could also look into whether these public figures have an impact on the population's willingness to vaccinate. In this regard, future studies should address the role of the political leader as a pro-health-behavior changer.

Although antivaccine positions are predominantly right-wing in the last years (Sorell & Butler, 2022), recent medical anthropological analyses have shown that narratives related to vaccine hesitancy/opposition cross various political categories, including politically left-leaning groups (Sturm et al., 2021). Along these lines, the findings of Recio-Román et al.'s (2021) study suggest that vaccination skepticism among populist groups is driven by distrust of science, which has become a political issue through politically colored information and misinformation. Even though left-wing antivaccine movements are less visible, it is possible that their reasons for opposing vaccination are qualitatively different from those of right-wing citizens. Accordingly, it is important to address the question of how citizens of left-wing political orientation would feel about vaccines and vaccination if a left-wing president were in office. Given that one of the examples of public narratives justifying vaccine rejection is the Big Pharma conspiracy theory (see Blaskiewicz, 2013), we suggest that future studies examine the role of far-left political orientation in justifying vaccine advocacy or rejection, in addition to the role of PVD in this relationship.

In sum, in this research article we were particularly interested in analyzing the influence that the political leader has on their constituents regarding the acceptance of COVID 19 vaccination. Lewis-Beck and Nadeau (2011) argue that political leaders can influence their respective partisans by providing "cues" that help their followers make complex decisions. We attempt to approach this question using the Brazilian case, as it provides a unique opportunity to empirically examine the influence of a leader with far-right ideals, President Bolsonaro, on the acceptance/rejection of COVID-19 vaccination. Therefore, the studies conducted examined how the past vote in the 2018 presidential election in Brazil and the opposing and ambiguous messages made by Bolsonaro impact the population's acceptance of COVID-19 vaccination. The results obtained showed that the past vote on a right-wing conservative leader, as well as the exposure of endorsements by this leader in relation to vaccination, influence health behavior, especially in those individuals with low perceived vulnerability to diseases.

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CONFLICT OF INTEREST

The authors declare no competing interest.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Supplementary Material S1

Table S1. Correlations among Measures

Table S2. Estimated Marginal Means and Standard Error (Study 2)

Table S3. Means and Standardized Deviations observed (Study 2)