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A Serial Mediation Model Predicting Covid-19 Vaccines Acceptance in Portugal: The Critical Role of Conspiracy Theories in the Wake of Perceived Quality of Government Communication and National Stereotypes

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Ever since the Covid-19 vaccination rollout, governments have aimed for herd immunity. Yet, many countries are far from achieving this goal mainly due to vaccine refusal. Previous research has pointed to conspiracy beliefs and the role of trust in governments as predictors of vaccine acceptance, yet a more comprehensive explanatory model is still missing. Using data from a convenience sample of 377 residents in Portugal (M_{age} = 33.56, SD = 13.67), the present study extends previous research by proposing a serial mediation model in the prediction of vaccine acceptance. The results confirm the critical role of conspiracy beliefs mediating the link between perceived quality of government communication and general vaccine acceptance (Model 1) as well as national stereotypes and acceptance of the Sinovac vaccine from China (Model 2). The implications are discussed considering that Portugal is currently ranked the second country in the world with the highest vaccination rate.

Keywords: Covid-19, conspiracy beliefs, vaccine acceptance, government communication

On March 11, 2020, the World Health Organization declared the Covid-19 outbreak a pandemic. Less than a year later, numerous pharmaceutical companies based in different countries announced the production of effective vaccines. In this context, vaccine acceptance has often been highlighted as a key element to overcome the pandemic (Succi, 2018). Vaccine acceptance is defined as the acceptance or active demand for vaccination once vaccines are readily made available (Murphy et al., 2021), and it has often been framed as the opposite of vaccine refusal or hesitancy (Fadda, Albanese, & Suggs, 2020) and found to depend on contextual factors, such as the severity of the disease or the vaccine's manufacturer (Succi, 2018). In the context of the current pandemic, media and government reports in many countries in the world have emphasized the potential severity of Covid-19 infections and that they can be mitigated via vaccination. At the same time, there have also been media reports about differences in the levels of effectiveness of different Covid-19 vaccines and their potential side effects. Consequently, a growing number of anti-vaccine movements seem to jeopardize the

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efforts of governments' vaccination campaigns, and social scientists are grappling with the question of what can be done to support the Covid-19 pandemic response (Bavel et al., 2020).

The present study aims to address this question by examining the role of government communication, conspiracy beliefs, and trust in government as predictors of Covid-19 vaccine acceptance in Portugal before the general vaccine rollout and during the national lockdown in March 2021. Portugal is today among the top three countries in the world with the highest vaccination rate (Mathieu et al., 2020); thus, arriving at a better understanding of the factors that played a role in increasing vaccine acceptance in Portugal might be informative for other countries that are currently struggling with vaccine acceptance.

An important characteristic of this pandemic is its global aspect, not just in terms of transmission but also in terms of vaccine responses and measures. Covid-19 vaccines have been developed in different countries and are constantly reviewed for approval in various destination countries due to their great demand. For instance, the European Medicines Agency (2021) has listed, among others, the Sinovac vaccine under rolling review for approval in Europe. Hence, it becomes crucial to not only understand what predicts the acceptance of Covid-19 vaccines in general, but also those of a specific origin. In the present study, we also aim to examine predictors of acceptance of the Sinovac vaccine, which is manufactured in China.

Predictors of General Vaccine Acceptance

Numerous studies have emerged on the predictors of Covid-19 vaccine acceptance. There is cumulative evidence that male gender, age (although with contradictory findings), higher educational attainment, and higher socioeconomic status, among others, are positively associated with Covid-19 vaccine acceptance (Aw, Seng, Seah, & Low, 2021; Lin, Tu, & Beitsch, 2020; Wake, 2021). Psychological variables, such as fear of Covid-19, have also been found to predict Covid-19 vaccine acceptance (Aw et al., 2021; Wake, 2021). More interestingly, several studies have found that belief in conspiracy theories and a lack of trust in governments and institutions are related to vaccine hesitancy (Burke, Masters, & Massey, 2021; Jolley & Douglas, 2014; Lin et al., 2020; Milošević Đorđević, Mari, Vdović, & Milošević, 2021; Murphy et al., 2021; Romer & Jamieson, 2020; Wake, 2021). These variables are especially important considering the current sociocultural contexts in which governments need their citizens to comply with protective measures and vaccine uptake to control the pandemic.

Conspiracy theories or beliefs have been defined as attempts to explain events as being caused by secret and often unlawful collusion of different actors, who have a malicious goal in mind (Islam et al., 2021; Jolley & Douglas, 2014; Swami & Furnham, 2014). The link between conspiracy beliefs and vaccine acceptance has already been established before the Covid-19 pandemic (Jolley & Douglas, 2014). Recent research focusing on the current pandemic with data from multiple countries also found that vaccine uptake among individuals holding conspiracy beliefs was significantly lower than among those who did not hold such beliefs (Burke et al., 2021). Furthermore, in a two-wave study, Romer and Jamieson (2020) found that endorsing conspiracy beliefs early in the pandemic was related to less preventive behavior and vaccination intentions four months later. They also found that vaccination hesitancy generally increased over time.

Social media have often been seen as the main culprit for the dissemination of conspiracy theories (Stecula, Kuru, & Hall Jamieson, 2020). For instance, a study conducted by Stecula and colleagues (2020) found that people who were exposed to vaccine-related information on social media were more likely to be misinformed and become vaccine-hesitant than those who were informed by traditional media. Islam and colleagues (2021) descriptively analyzed social media posts among other Internet sources (e.g., news articles, online reports) and identified theories about secret reagents hidden in the vaccine or about a global surveillance conspiracy (i.e., vaccines serve to inject a microchip that will be used for surveillance purposes). In this context, beliefs in alternative explanations might fill an informational vacuum in the absence of a clear communication policy by the respective authorities (Swami & Furnham, 2014). There is some evidence for this in a study conducted by Quinn and colleagues (2013), which emphasizes the critical role of government communication in a pandemic. In the context of the H1N1 outbreak in the United States, they found that individuals who perceived their government to disseminate clear and consistent communication about the pandemic were also more trusting toward their government, which in turn predicted intentions to get vaccinated against H1N1 in the future. It is conceivable that clarity and transparency in governmental communication surrounding Covid-19 counteract conspiracy beliefs, thereby increasing vaccine acceptance.

Another factor identified as a predictor of vaccine acceptance is trust in the government and institutions. Political trust is defined as "the faith people have in their government and, as such, represents a form of diffuse support for the authorities" (Lalot, Heering, Rullo, Travaglino, & Abrams, 2022, pp. 2–3), and has been found to increase compliance with governmental demands and regulations (Kim & Kim, 2020; Pagliaro et al., 2021). In yet another study conducted by Quinn, Kumar, Freimuth, Kidwell, and Musa (2009), it was found that trust in government was related to higher willingness to receive a vaccine during the H1N1 pandemic in the United States. Similarly, a recent survey conducted across multiple countries found that respondents who reported higher trust in their government were also more likely to accept a Covid-19 vaccine than those who did not (Lazarus et al., 2021).

Some scholars proposed more complex models and examined the effects of conspiracy beliefs on vaccine acceptance via trust in governments and institutions. Jolley and Douglas (2014) found that conspiracy beliefs about the measles, mumps, and rubella vaccine were significant predictors of the perceived dangers of vaccines, and of feelings of powerlessness, disillusionment, and distrust in authorities, which in turn predicted vaccine refusal in the United States. Recently, a study conducted in Serbia (Milošević Đorđević et al., 2021) found that the belief in anti-vaccine conspiracy theories predicts Covid-19 vaccine intentions and that this relationship was mediated by decreased trust in science, trust in medical institutions and authorities, and knowledge about vaccines. Hence, there is some evidence that endorsing conspiracy beliefs is related to a greater vaccine reluctance, which can be explained with a lack of trust in authorities.

The present study extends previous research by proposing a more complex serial mediation model to explain Covid-19 vaccine acceptance. Considering the studies reviewed above, it was expected that endorsing conspiracy beliefs is related to a greater vaccine reluctance, which can be explained with a lack of trust in authorities. However, such a model does not provide any insight into what governments could do to effectively tackle conspiracy beliefs and consequently increase Covid-19 vaccine uptake. Hence, we examine the critical role of perceived government communication about the Covid-19 pandemic in the prediction of vaccine acceptance and mediated by both conspiracy beliefs and trust in government. To the

best of our knowledge, this is the first study proposing such a comprehensive model showing serial mediation (Figure 1). More specifically, it hypothesizes that:

H1a: Quality of communication is positively associated with vaccine acceptance.

H1b: Conspiracy beliefs will mediate the relationship between quality of communication and vaccine acceptance.

H1c: Trust in the Portuguese government will mediate the relationship between quality of communication and vaccine acceptance.

H1d: Quality of communication will be associated with vaccine acceptance through a serial mediation process with the mediator conspiracy beliefs predicting the mediator trust in the Portuguese government.

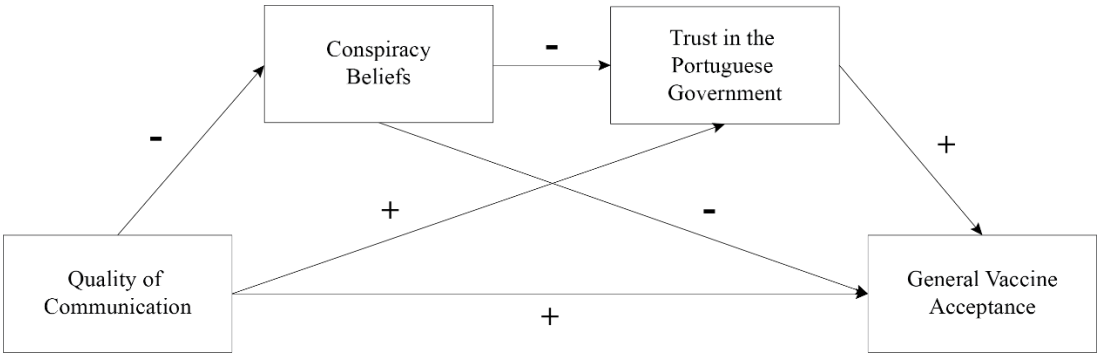


Figure 1. Hypothesized serial mediation model predicting general vaccine acceptance.

Sinovac Acceptance

To date, only a few studies have examined the relationship between Covid-19 vaccine acceptance and the vaccine's country of manufacture (Lin et al., 2020). An experimental study conducted in France found that vaccine hesitancy depended on a combination of factors, among others the country of the vaccine manufacturer: Only 27% of participants would accept Covid-19 vaccines manufactured in China, while 43% would remain hesitant unless Covid-19 vaccines were manufactured in the United States or Europe (Schwarzinger, Watson, Arwidson, Alla, & Luchini, 2021).

China plays a significant role in the Covid-19 pandemic because the outbreak is the result of the spread of coronavirus, which was identified in December 2019 in the city of Wuhan in China. Since then, China has been at the center of the world's attention, and many conspiracy theories implicate China, even leading to acts of Sinophobia that have increased exponentially all over the globe (Gao, 2022). In this context, the present study aims to identify the possible predictors of Sinovac's acceptance by drawing on the conceptual model described above. However, including the variable perceived quality of communication by the Chinese government is less useful in this context because there is no direct transmission of Covid-

19 related information to Portuguese citizens by the Chinese government. Instead, stereotypes about the Chinese may play an important role in predicting Sinovac's acceptance.

A study conducted by Bertin, Nera, and Delouvée (2020) found that conspiracy theories about China predicted negative attitudes toward vaccination. Furthermore, van Prooijen and Douglas (2018) argued that conspiracy beliefs usually consist of beliefs about a powerful or hostile outgroup that is conspiring against the perceiver's ingroup. In this context, conspiracy beliefs may be related to the stereotypes about a specific outgroup that is perceived as hostile and threatening. However, to the best of our knowledge, the relationship between stereotypes and conspiracy beliefs in the context of Covid-19 vaccine acceptance has never been studied before. Thus, we expand the model previously proposed (Figure 2) and hypothesize that:

H2a: Negative stereotypes about the Chinese are negatively associated with Sinovac acceptance.

H2b: Conspiracy beliefs will mediate the relationship between stereotypes about the Chinese and Sinovac acceptance.

H2c: Trust in the Chinese government will mediate the relationship between stereotypes about the Chinese and Sinovac acceptance.

H2d: Stereotypes about the Chinese will be associated with Sinovac acceptance through a serial mediation process, with the mediator conspiracy beliefs predicting the mediator trust in the Chinese government.

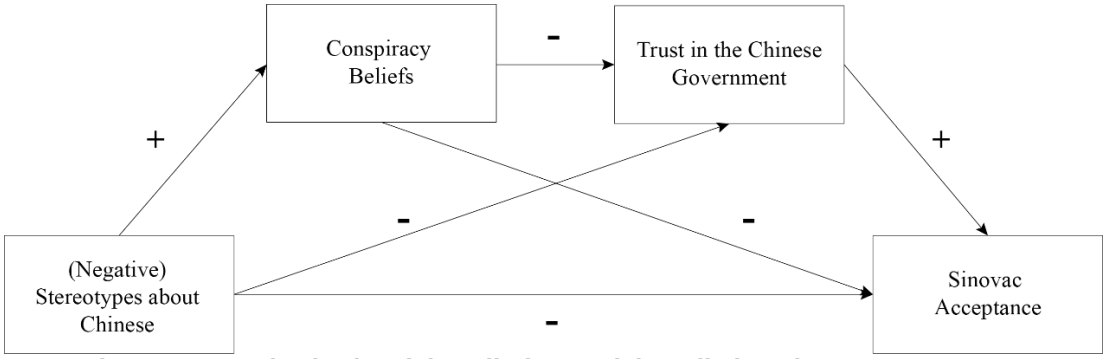


Figure 2. Hypothesized serial mediation model predicting Sinovac acceptance.

Methods

Participants and Procedure

Data were collected between March 24 and April 13, 2021, via convenience and snowball sampling with the help of research assistants in the context of the project "Covid-19 Survey in Portugal," resulting in an initial convenience sample of 426 respondents. To be included in the study, participants

needed to (a) be at least 18 years old and (b) reside in Portugal at the time of the survey. Participants that did not meet these criteria were excluded from the database, together with those that did not answer any questions of the survey. The final sample size consisted of 377 respondents. The sample mean age was 33.56 years (SD = 13.67), which is somewhat lower than the national median age of 45.8 years in 2021 (Fundação Francisco Manuel dos Santos, 2022). Most participants were female (66%) and indicated having Portuguese nationality (97.4%), which corresponds roughly to the national demographics (53% female and 96.26% Portuguese nationals; Instituto Nacional de Estatística, 2011). The sample consisted mainly of workers (46.5%) and university students (31.5%), which is similar to the country's employment rate of 54% in 2021, yet the share of tertiary education students is much lower in the current resident population (3.7% in 2020; Fundação Francisco Manuel dos Santos, 2022). All participants were educated to some level, with most having attained at least a secondary high school degree (93.5%); this is somewhat higher than the educational attainment of the general population aged 25 to 64 (59.5% in 2020). For the question "On a scale from 1 to 7, how do you consider the standards of living of your family?" where 1 = far below the average and 7 = far above the average, the sample mean was 4.25 (SD = 1.04).

Table 1. Descriptive Statistics of the Sample Sociodemographic Characteristics.

		M	*(SD)*	*n*	*(%)*
Age		33.56	(13.67)		
Sex	Female			217	(66.0)
	Male			108	(32.8)
	Other/do not wish to answer			4	(1.2)
Nationality	Portuguese			301	(97.4)
	Other			8	(2.6)
Education	Primary school			6	(1.8)
	Incomplete secondary school (ninth grade)			15	(4.6)
	Complete secondary school (12th grade)			140	(43.1)
	Bachelor's degree or equivalent			118	(36.3)
	Master's degree or equivalent			40	(12.3)
	PhD or equivalent			6	(1.8)
Occupation	Worker			152	(46.5)
	University student			103	(31.5)
	Working student			22	(6.7)
	Unemployed			20	(6.1)
	Laid off			16	(4.9)
	Retired			4	(1.2)
	Other			10	(3.1)

Materials

Survey completion occurred on Qualtrics.com. All measures were administered in Portuguese (the full survey is available as an online supplement[2]). Participants first read the informed consent form, then responded to the questionnaire, and at the end of the study read a debriefing. Scales that did not already exist in Portuguese were translated for the purpose by taking a committee approach. Composite scores were computed for all scales after reverse coding respective items, if applicable, and checking the reliability of the scales.

General Covid-19 Vaccine Acceptance

Two items proposed by Wang and colleagues (2020) measured Covid-19 vaccine acceptance on a five-point Likert-type scale, ranging from 1 (totally disagree) to 5 (totally agree). The items were: "In general, I would accept to receive a Covid-19 vaccination if it was developed successfully and approved" and "In general, I would like to receive a Covid-19 vaccination as soon as it will be available to me." The Spearman-Brown coefficient for these two items was .92, displaying high internal consistency.

Sinovac Acceptance

The two items assessing general Covid-19 vaccine acceptance were adapted to measure acceptance of the Sinovac vaccine, which is manufactured in China: "If the Sinovac vaccine of Chinese origin was approved in Portugal, I would accept to receive it" and "I would like to be vaccinated as soon as the Sinovac vaccine will be available to me." Answers ranged from 1 (totally disagree) to 5 (totally agree). The Spearman-Brown coefficient for these two items was .93.

Conspiracy Beliefs

The Conspiracy Beliefs scale (Bierwiaczonek, Kunst, & Pich, 2020), consisted of three items measured on a seven-point Likert-type scale, ranging from 1 (totally disagree) to 7 (totally agree). The items were "Do you believe that Covid-19 is human-made?," "Do you believe that Covid-19 is part of a biological warfare program?," and "Do you believe that Covid-19 represents an attempt to hurt the Western world?" The scale displayed a high internal consistency close to the one in the original study, with Cronbach's alpha being .90.

Trust in the Portuguese Government

The Trust in the Portuguese Government scale was adapted from a study by Quinn and colleagues (2009). The original scale measured participants' trust in the U.S. government's handling of the swine flu (H1N1) pandemic on a four-point scale. The adapted scale consisted of seven items measured on a five-point Likert-type scale, ranging from 1 (totally disagree) to 5 (totally agree). Sample items included "I consider the government open in the divulgation of information about Covid-19" and "I believe that the government is committed to protecting me from Covid-19." Cronbach's alpha for this scale was .90.

[2] https://osf.io/z2rjh/files/osfstorage/635a6e8ffbb11402ff7ea61f

Trust in the Chinese Government

The Trust in the Portuguese Government scale was adapted to measure trust in the Chinese government by selecting those items that participants could respond to when referring to the Chinese government. A total of three items were selected, measuring trust on a five-point Likert-type scale, ranging from 1 (totally disagree) to 5 (totally agree): "I consider the Chinese government open in the divulgation of information about Covid-19," "I consider the Chinese government honest with information about Covid-19," and "I consider the Chinese government competent in handling Covid-19." Cronbach's alpha for the three items was .70.

Quality of Communication

The Quality of Communication scale used in this study was informed by items from Quinn and colleagues (2013) and Kim and Kim (2020). The scale consisted of five items measuring respondents' perception of the quality of communication received from the Portuguese government about Covid-19 (e.g., "The information transmitted by the government is professional and based on science."). Answers ranged from 1 (totally disagree) to 5 (totally agree). Cronbach's alpha for this scale was .87.

Stereotypes of Chinese

This measure was derived from Zhang's (2015) study and asked participants to rate the extent to which 14 different adjectives were associated with individuals of Chinese origin (e.g., "arrogant," "violent," "corrupt"). Each item was rated on a scale ranging from 1 (totally disagree) to 7 (totally agree). Ten positive adjectives were reverse coded (e.g., "generous," "honest," "accountable") before computing an index, so that higher scores indicated more negative stereotypes. The scale showed high internal consistency, with Cronbach's alpha of .85.

Covariates

Fear of Covid was considered a covariate in predicting vaccine acceptance. It was measured with the Fear of Covid-19 scale, originally proposed by Ahorsu and colleagues (2020), which has already been validated in the Portuguese context (Soares, Afonso, Martins, Pakpour, & Rosa, 2022). The scale consists of seven items measured on a five-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Sample items included "I am afraid of losing my life because of Covid-19" and "I cannot sleep because I'm worried about getting Covid-19." The internal consistency of the scale was similar to the one previously found with a Portuguese sample (Soares et al., 2022), with Cronbach's alpha of .85.

The survey also contained sociodemographic questions such as participants' age, gender, nationality, educational attainment, and socioeconomic status.

Data Analysis

After removing the cases that did not fit the above-mentioned inclusion criteria, descriptive statistics were computed, and Pearson's correlation coefficients for all variables were obtained. Finally, after verifying linearity assumptions for the variables included in the models, two serial mediation models were carried out. In the first model, general Covid-19 vaccine acceptance was used as a dependent variable (Y) and quality of communication as independent (X). The mediating variables for this model were conspiracy beliefs (M1) and trust in the Portuguese government (M2). In the second model, Sinovac acceptance was used as a dependent variable (Y) and stereotypes about the Chinese as independent (X). The mediating variables for this model were conspiracy beliefs (M1) and trust in the Chinese government (M2). Fear of Covid-19, age, gender, educational level, and socioeconomic status were included as covariates in both models. Analyses were computed using SPSS 27 and PROCESS v 3.5. Both mediation analyses were performed using PROCESS Model 6, 5,000 bootstrapped samples, and the level of confidence set at 95%. The indirect effects of the mediation were significant when the confidence interval (CI) did not comprise the value zero. Due to listwise deletion of missing values in PROCESS, the serial mediation models were based on a sample size of 322 in Model 1 and 317 in Model 2.

Results

Descriptive statistics and Pearson's correlations of all variables are reported in Table 2. Statistically significant correlations were found among all variables in the expected direction. Most importantly, general Covid-19 vaccine acceptance was positively correlated with trust in the Portuguese government and quality of communication and negatively correlated with conspiracy beliefs. Sinovac acceptance was positively correlated with trust in the Chinese government, and negatively correlated with (negative) stereotypes about the Chinese and conspiracy beliefs.

Table 2. Descriptive Statistics and Pearson's Correlations for Key Variables.

									Descriptive Statistics		
		1	2	3	4	5	6	7	*M*	(SD)	n
1.	General vaccine acceptance	—							4.09	(1.19)	328
2.	Sinovac acceptance	.635**	—						3.42	(1.34)	326
3.	Conspiracy beliefs	−.342**	−.349**	—					3.33	(1.81)	348
4.	Trust in the Portuguese government	.268**	.264**	−.319**	—				3.25	(0.91)	371
5.	Trust in the Chinese government	.121*	.334**	−.258**	.308**	—			2.35	(0.89)	369
6.	Quality of communication	.317**	.344**	−.357**	.727**	.332**	—		3.50	(0.80)	353

7.	Stereotypes about the Chinese	−.141*	.365**	.156**	.144**	−.279**	−.232**	—	3.25	(0.89)	346

Note. *p < .05, **p < .001

Mediation Model: General Vaccine Acceptance

The first serial mediation model was computed to test whether quality of communication was related to general Covid-19 vaccine acceptance, and whether this relationship was mediated by conspiracy beliefs and trust in the Portuguese government. As illustrated in Figure 3, quality of communication was positively associated with vaccine acceptance (β = .223, p < .05, 95% CI [.112, .552]), thus, H1a was supported. Furthermore, quality of communication was negatively associated with conspiracy beliefs (β = −.344, p < .001, 95% CI [−1.005, −.541]), which in turn were negatively associated with general Covid-19 vaccine acceptance (β = −.284, p < .001, 95% CI [−.258, −.118]). The indirect effect of the path between quality of communication and general vaccine acceptance via conspiracy beliefs was statistically significant (β = .098, 95% CI [.053, .150]). Thus, H1b was also supported. Quality of communication was also positively associated with trust in the Portuguese government (β = .711, p < .001, 95% CI [.709, .887]); however, the relationship between trust in the Portuguese government and general Covid-19 vaccine acceptance was nonsignificant (β = .029, p > .05, 95% CI [−.156, .233]), as was the indirect effect of the path via trust (β = .021, 95% CI [−.095, .133]). Thus, H1c was not supported. Finally, the relationship between conspiracy beliefs and trust in the Portuguese government was also nonsignificant (β = −.051, p > .05, 95% CI [−.066, .014]). Since the indirect effect of the path between quality of communication and general Covid-19 vaccine acceptance via conspiracy beliefs and trust in the Portuguese government was not statistically significant (β = .001, 95% CI [−.003, .006]), H1d was not supported. Among covariates, fear of Covid-19 (β = .143, p < .05, 95% CI [.058, .378]) and socioeconomic status (β = .152, p < .05, 95% CI [.052, .295]) were significantly and positively associated with general vaccine acceptance.

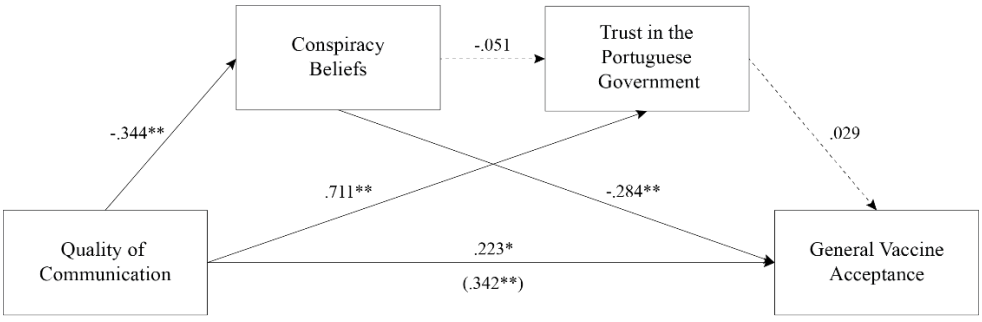
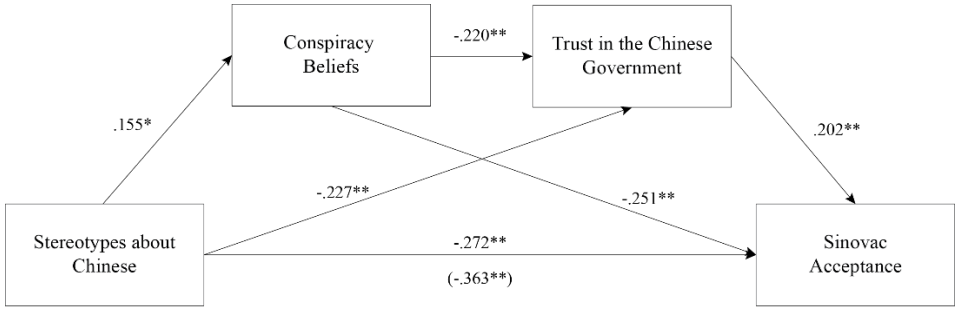


Figure 3. Serial mediation results predicting general vaccine acceptance.

Note. Figure 3 shows standardized regression coefficient. Coefficients of the total effects are shown in parentheses. QC = Quality of communication; CB = Conspiracy beliefs; TR_{PT} = Trust in the Portuguese government; VACC = General vaccine acceptance. *p < .05, **p < .001.

Mediation Model: Sinovac Acceptance

The second serial mediation tested whether negative stereotypes about the Chinese were related to Sinovac acceptance, and whether this relationship was mediated by conspiracy beliefs and trust in the Chinese government. Figure 4 shows that (negative) stereotypes are negatively associated with Sinovac acceptance in such a way that more negative stereotypes are related to lower acceptance (β = −.272, p < .001, 95% CI [−.578, −.260]). Accordingly, H2a was supported. The relationship between stereotypes and conspiracy beliefs was positive and significant (β = .155, p < .05, 95% CI [.090, .554]). The indirect effect of the path between stereotypes and acceptance via conspiracy beliefs was also significant (β = .039, 95% CI [−.078, −.009], thus, H2b was supported. Furthermore, there was a negative significant association between stereotypes and trust in the Chinese government (β = −.227, p < .001, 95% CI [−.341, −.124]) and a positive association between trust and Sinovac acceptance (β = .202, p < .001, 95% CI [.144, .143]). The indirect effect of the path between stereotypes and acceptance via trust was also significant (β = −.046, 95% CI [−.084, −.018]), providing support for H2c*.* Finally, the relationship between conspiracy beliefs and trust in the Chinese government was negative and significant (β = −.220, p < .001, 95% CI [−.160, −.057]), as was the indirect effect of the path between stereotypes and acceptance via conspiracy beliefs and trust (β = −.007, 95% CI [−.016, −.001]), therefore, H2d was supported. No covariates were significantly associated with Sinovac acceptance.



Ind. effect 1 (ST - CB -$VACC_{CH}$): -.039 (95% CI [-.078, -.009])
Ind. effect 2 (ST - TR_{CH} - $VACC_{CH}$): -.046 (95% CI [-.084, -.018])
Ind. effect 3 (ST - CB - TR_{CH} - $VACC_{CH}$): -.007 (95% CI [-.016, -.001])
* p < .05
** p < .001

Figure 4. Serial mediation results predicting Sinovac acceptance.

Note. Figure 4 shows standardized regression coefficient. Coefficients of the total effects are shown in parentheses. ST = Stereotypes about the Chinese; CB = Conspiracy beliefs; TR_{CH} = Trust in the Chinese government; $VACC_{CH}$ = Sinovac acceptance. *p < .05, ** p < .001.

Discussion

The present study extended previous research on Covid-19 vaccine acceptance by (1) distinguishing between general Covid-19 and Sinovac vaccine acceptance (developed and manufactured in China) and (2) examining a comprehensive explanatory model via serial mediation. The results generally corroborate the critical role that conspiracy theories play in mediating the relationship between the predictor variables and vaccine acceptance. However, the current study also points to new insights that could inform government actions.

In the first model, we found that clear and coherent government communication about the Covid-19 pandemic is positively related to general Covid-19 vaccine acceptance, and this link is mediated by conspiracy beliefs. Hence, governments that invest in high-quality communication about the pandemic may be able to counteract the surge of conspiracy beliefs, which in turn may help to increase vaccine acceptance. We also expected to find a significant relationship between belief in conspiracy theories and trust in the Portuguese government, or between trust and vaccine acceptance, however, this was not the case in our data. Although previous research found trust in governments to be related to conspiracy beliefs and vaccine acceptance (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021), other studies found only weak relations (e.g., between trust in government actions and intent to receive the H1N1 vaccine; see Quinn et al., 2009, 2013). Even though more research is needed to replicate the findings in other contexts, the current study results, together with findings from previous literature, seem to corroborate the significance of conspiracy beliefs for tackling vaccine refusal.

In the second model, we found that higher negative stereotypes about the Chinese predicted higher beliefs in conspiracy theories and lower trust in the Chinese government, which in turn predicted lower vaccine acceptance. These results are in line with previous research (Bertin et al., 2020; Schwarzinger et al., 2021). To the best of our knowledge, this was the first study to examine the role of stereotypes as antecedents of Covid-related conspiracy beliefs and vaccine acceptance. Future studies could further examine this relationship with experimental designs and could also include vaccines manufactured in other countries (e.g., Sputnik, manufactured in Russia) to corroborate that sociopsychological variables play a role in vaccine acceptance. This is especially important when considering that the European Medicines Agency is currently listing vaccines that are developed and manufactured in diverse countries as being under review for approval in the European Union. Given the vaccine refusal that some European countries are battling with, it seems paramount to better understand the factors that drive this vaccine nonacceptance. Our study suggests that national stereotypes might feed into conspiracy beliefs.

Overall, our findings highlight the important role of conspiracy beliefs in dealing with the Covid-19 pandemic. Since its beginnings, conspiracy beliefs have been identified as an obstacle to the adherence to preventive measures, such as social distancing, prophylactic isolation, and the use of face masks (Bierwiaczonek et al., 2020) as well as to vaccine acceptance (Burke et al., 2021; Romer & Jamieson, 2020). Governments and health authorities, in collaboration with traditional media outlets, should ensure a good quality of communication in vaccination campaigns to mitigate the surge of conspiracy theories, which are often disseminated on social media platforms and difficult to control. Further research is needed to identify other factors that may prevent the spread and development of such theories, especially regarding vaccines that have been the object of political and mediatic debate and controversy (e.g., AstraZeneca). More research is also needed to identify good practices of the Portuguese government in its communication measures about the pandemic given the fact that it is one of the few countries worldwide that is above the 80% vaccination threshold as of November 2021 (86.4% of the population are fully vaccinated; Mathieu et al., 2020).

Finally, the present study has some limitations. First, because of the cross-sectional nature of our research, we cannot assert causality between our variables. Second, a convenience sample was used, and a comparison with the Portuguese general population has shown that the sample was more highly educated. This might have mitigated our results given that several studies have found higher educational level to be

positively associated with vaccine acceptance (Schwarzinger et al., 2021; Wake, 2021) and political trust (Rieger & Wang, 2022) and to be negatively associated with conspiracy beliefs (van Prooijen, 2017).

Third, other variables that were not considered here may also contribute to explaining the variance in vaccine acceptance. Future research could adopt experimental and longitudinal designs, as well as random-sampling techniques, and consider other variables (e.g., cultural norms of conformity, collectivistic vs. individualistic values) as predictors of vaccine acceptance.

The present research was conducted in Portugal between March and April 2021, when the country was in a national lockdown and people relied heavily on the news to know more about the pandemic and government actions. In hindsight, it has become clear that Portugal is in a better position than many other member states of the European Union, and the question is whether this could inform governance in other countries. A study conducted by Leonhardt and Pezzuti (2022) found that collectivism was positively associated with vaccine acceptance across more than 50 countries. Indeed, according to Hofstede Insights (2021) Portugal scores relatively high on the cultural dimension of collectivism. Given that other countries are struggling with vaccine uptakes and the development of new variants, further cross-cultural studies are urgently needed to better understand the factors that involve vaccine acceptance. Considering the great demand for vaccines worldwide and the shortages that were encountered in the first half of 2021 in Europe, the acceptance of vaccines developed and manufactured in countries such as China and Russia may become crucial. At the same, current geopolitical tensions between the West and these countries may further kindle stereotypes and lead to more conspiracy beliefs and less trust surrounding these governments and the respective vaccines. To conclude, we think this study makes an important contribution to finding pathways in tackling one of the greatest health crises of the 21st century.

Compliance With Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional Research Committee and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Furthermore, the present cross-sectional study used data collected in the context of the project "Covid-19 Survey in Portugal," which was approved by the Ethics Committee of the Instituto Universitario de Lisboa, ISCTE-IUL (Approval No. 75/2021). Informed consent was obtained from all individual adult participants included in the study.

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