

Article

# Conspiracy Beliefs and Acceptance of COVID-Vaccine: An Exploratory Study in Italy

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**Abstract:** The availability of vaccines does not mean that people will be willing to get vaccinated. For example, different conspiracy beliefs on the adverse effects of vaccines may lead people to avoid collective health measures. This paper explores the role played by antecedents of COVID-related conspiracy beliefs, such as the role of political ideology and the endorsement of moral purity values, and the consequences of COVID-related conspiracy beliefs in terms of the acceptance of a COVID vaccine (when available) via structural equation modelling (SEM). A sample of 590 Italian participants filled in a questionnaire implemented using the Qualtrics.com platform, during the first Italian lockdown in April–May 2020. Results showed that endorsing purity values predicted stronger negative attitude towards COVID-vaccines. Moreover, conspiracy beliefs negatively predicted general attitudes toward vaccines. Faith in science negatively predicted general and COVID-related conspiracy beliefs, with those believing more in science also less endorsing general and COVID-related conspiracy beliefs. The attitudes towards the vaccines mediated the relationship between COVID-related conspiracy beliefs and attitudes towards COVID vaccine.

**Keywords:** COVID-19 vaccine; attitudes; conspiracy beliefs; faith in science; Italy

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## 1. Introduction

Compliance with public health advice is mandatory during extensive emergencies, such as the current COVID-19 pandemic. However, in a European survey it was reported that a certain group of people are unwilling to cooperate (Hamburg University 2020; Neumann-Böhme et al. 2020). For instance, among the pro-health behaviors in times of COVID-19, considerable hope is being hinged on the promise of a SARS-CoV-2 vaccine to control the COVID-19 pandemic. However, the availability of the vaccine does not directly mean that people will be willing to get vaccinated. For example, different conspiracy beliefs on the adverse effects of vaccines may lead people to avoid collective health measures (Jolley and Douglas 2014a).

In recent years, the SAGE Working Group on Vaccine Hesitancy referred to “vaccine hesitancy” as a delay in the acceptance or even the refusal of having a vaccination despite its availability (MacDonald 2015). Vaccine hesitancy is complex and context-specific, varying between the time, place, and type of vaccine. Moreover, even those who are vaccinated can harbor diffidence towards certain aspects of vaccination (Enkel et al. 2018; Peretti-Watel et al. 2020; Wang et al. 2015). Dror et al. (2020) noticed that regarding the SARS-CoV-2 vaccine (when it becomes available), a segment of the population could

display a hesitant attitude towards the vaccine, and its availability will not guarantee the protection of the population. Similarly, studies addressing the COVID-19 pandemic in 2020 have shown that about a quarter of the U.S. population has little or no interest in taking the COVID-19 vaccine, once available (Reuters/Ipsos 2020; Thunström et al. 2020). Along the same lines, a study in France during the lockdown in the spring of 2020 found that 26% of respondents stated that if a vaccine against SARS-CoV-2 becomes available, they would rather not use it (Peretti-Watel et al. 2020). Moreover, vaccine hesitancy was associated with a decrease in COVID-19 vaccine acceptance in France (Detoc et al. 2020).

Among the many factors affecting the decision to vaccinate, conspiracy theories have been spreading fast during the COVID-19 pandemic (e.g., Oleksy et al. 2021). Conspiracy theories have been defined as attempts to explain the ultimate causes of significant social and political events with claims of secret plots orchestrated by powerful and malevolent actors (Douglas et al. 2019). This idea draws from the term “the conspiracy theory of society” by Popper (2014), and from what Hofstadter called “conspiratorial fantasies” (Hofstadter 1964). Some such theories include the following: COVID-19 is part of a government bioweapons programme (Freeman et al. 2020; Sutton and Douglas 2020), 5G cell towers are spreading COVID-19 (Ahmed et al. 2020; Bruns et al. 2020; Jolley and Paterson 2020), and pharmaceutical companies are encouraging the spread of COVID-19 for profit-making purposes (e.g., Ellis 2020; Muller 2020). These conspiracy theories can have harmful consequences. For example, conspiracy theories concerning COVID-19 have played a role in reducing compliance with health protective behaviors such as frequent hand-washing and social distancing (Allington et al. 2020; Bierwiazzonek et al. 2020; Swami and Barron 2020). Moreover, COVID-related conspiracy beliefs have been found to be strongly related to broader conspiracy beliefs and to more negative attitudes towards government responses to the crisis (Georgiou et al. 2020).

As for conspiracy beliefs and vaccination intention, some authors have suggested that anti-vaccination beliefs are part of a psychological propensity to believe in conspiracies (Goldberg and Richey 2020). Vaccine conspiracy beliefs have been found to be negatively related to parents’ willingness to vaccinate their children with the HPV vaccine (Callaghan et al. 2019; Hornsey et al. 2018; Sarathchandra et al. 2018; Shapiro et al. 2016). In the same line, belief in COVID-19-related conspiracy theories have been found to be inversely related to the intention to undertake the SARS-CoV-2 vaccine (Earnshaw et al. 2020; Romer and Jamieson 2020). COVID-19 conspiracy beliefs have also been found to be associated with negative attitudes toward vaccine science and negatively predicted the intentions to be vaccinated against COVID-19 in the future (Bertin et al. 2020). General vaccine hesitancy has been found to be one of the most important deterrents of COVID-vaccination (Thunström et al. 2020). However, little research has investigated (1) the antecedents of COVID-related conspiracy beliefs and (2) the possible mediators of the vaccination intention. The present study will shed light on these questions by investigating conspiracy beliefs and vaccination intentions in Italy during the COVID-19 lockdown in the spring 2020.

Among the antecedents of conspiracy beliefs, some studies have pointed to the political ideology as a belief system about the proper order of society and how it can be achieved (Erikson and Tedin 2015). As for the structure of ideology, many refer to the left-right dimension, with “liberal” being a substitute for “left” and “conservative” for “right”. This dimension points to attitudes concerning change versus stability and equality versus inequality (Jost et al. 2009). Despite the end of ideologies recorded in many European countries, a core of semantic areas such as equality/inequality, the economic dimension, social change/maintenance of the status quo, democracy/anti-democracy, and class differences, persisted throughout a thirty-year period in Italy (Corbetta et al. 2009). Political conservatism (i.e., right-wing voting) has been found to be related to higher levels of conspiracism in the USA (e.g., Hornsey et al. 2020) and in Italy (e.g., Mancosu et al. 2017).

Additionally, political conservatism has been found to be negatively related to vaccine acceptance (Baumgaertner et al. 2018; Lewandowsky et al. 2013; Rutjens et al. 2018). However, other studies have found a modest to absent role of political ideology in predicting vaccine acceptance (Kahan 2015; Lewandowsky et al. 2013; Scott et al. 2016). It is possible that conservatives generally oppose the government intrusion arising from mandatory vaccination programs, leading to vaccination refusal (Kahan et al. 2010).

Moreover, moral reasoning could also play a role in conspiratorial thinking. Morality is a complex concept that appears in the literature with a variety of definitions from philosophy to social sciences (Kohlberg 1969; Turiel 1983). Drawing inspiration from Shweder's theory (Shweder et al. 1997), the Moral Foundations Theory (MFT; Haidt and Joseph 2004; Haidt and Graham 2007) points to (1) individualizing foundations, related to care for and devotion to the discomfort of others (harm/care) and concern for justice and rights (fairness/reciprocity); (2) binding foundations, describing the concern for and interest in social solidarity and responsibilities of group membership (ingroup/loyalty); social order, social role fulfilment and respect for traditions and institutions (authority/respect); and interest in control of impulses and desires (purity/sanctity). Specifically, moral concerns pertaining to binding moral foundations have been found to be positively associated with conspiracy beliefs (Leone et al. 2019). As for the relationship between moral purity and attitudes towards vaccination, moral purity has been found to be a good predictor of vaccine scepticism (Callaghan et al. 2019; Rutjens et al. 2018). Additionally, rejecters of vaccinations have exhibited a heightened moral preference for purity (an abhorrence for impurity of body) (Hornsey et al. 2018; Rossen et al. 2019).

Conspiratorial thinking is generally opposed to faith in science (Lewandowsky et al. 2013). Moreover, political orientation and morality separately were found to strongly negatively predict trust in science, with a decrease in trust in science among conservatives in the US in recent years (e.g., McCright et al. 2013; Rutjens et al. 2018). The willingness to take a COVID-19 vaccine was correlated to trust in research and in vaccines (Palamenghi et al. 2020). Trust in the health system was reliably found to predict vaccine uptake (Gilles et al. 2011; Manika et al. 2014) and was found to be significantly associated with retrospective reports of a vaccine uptake (Casiday et al. 2006; Cheng et al. 2010). No studies focusing on vaccine uptake have examined trust in science, trust in the media, or trust in influential individuals outside the health care system (such as friends and family, religious leaders, alternative healthcare professionals) (for a review see Larson et al. 2018).

Furthermore, support for the governmental response to the pandemic could be related to conspiracy beliefs and play a role in the acceptance of COVID vaccines. Conspiracy theories often share the idea that high power actors (e.g., intelligence agencies, government, corporations, and pharmaceutical industries) do not comply with rules and laws but aim to promote their own interests. If that is true, governments are either actively involved or complicit by omission (from preventing such goings-on) (Imhoff et al. 2021). Exposure to information supporting conspiracy theories has been found to reduce intentions to engage in politics and civic behavior such as vaccinations (Jolley and Douglas 2014a, 2014b).

Finally, the degree that participants feel that they can trust their government to provide accurate information during the crisis could also affect support for COVID vaccines. Support depends on the perception that the government is trustworthy in providing transparent information devoid of outside influences (e.g., Conway and Repke 2019). Psychological contamination has been found to predict the likelihood of opposing both governmental and civilian action on climate change, rainforest protection, and recycling (Conway and Repke 2019).

*Context: Italy during the COVID-19 Pandemic*

Italy provides a fruitful context to investigate vaccination intentions during the COVID-19, as it was one of the first European countries to be severely affected by the COVID-19 pandemic. Despite the strict containment measures immediately adopted by the Italian government, Italy is currently the European country with the second largest number of COVID-19 deaths and the third to fourth largest number of cases (European Centre for Disease Prevention and Control 2020). The adopted containment measures were generally called lockdown and included: staying at home and leaving only for food and medical necessities, remote instruction for schools and universities, shutting business (except for food, healthcare, and IT industries) or working from home, and avoiding physical proximity to non-cohabiting others.

While Italy used to be a country with a long-standing tradition of high coverage of vaccinations, during the last decades infant immunization coverage has decreased alarmingly, in line with what has happened in other European countries. To address the decrease in immunization coverage, in July 2017, the Italian Parliament issued a new law, the “Italian National Immunization Prevention Plan 2017–19” (n. 119/2017), prescribing children to be immunized against 10 diseases (e.g., Tetanus, Poliomyelitis, Hepatitis B, etc.), to be allowed to register for kindergartens, maternal schools, and compulsory schools (Bonanni 2018).

To answer the questions raised by the previous studies, this paper aims to explore (1) the role played by antecedents of COVID-related conspiracy beliefs, such as the role of political ideology and the endorsement of moral purity values, and (2) the behavioral consequences of COVID-related conspiracy beliefs in terms of acceptance of the COVID vaccine (when available). Additionally, the possible role of support in the governmental response to the COVID pandemic and perception of contamination of information coming from the government are explored via structural equation modelling (SEM). The hypothesized model is shown in Figure 1. The model is aimed to be read from the left to the right, with one dimension on the left predicting a dimension on the right. The relationship between the dimensions is exemplified in the direction of the arrow. If no arrow connects two dimensions, then the model hypothesizes that there is no relationship between the two dimensions. The directions of the paths hypothesized in the model are based on previous theories and research findings.

Among the topics investigated by researchers, political orientations were found to be related to the anti-science movement, particularly among conservatives (e.g., Gauchat 2012; McCright et al. 2013; Pittinsky 2015). For instance, in the US Democrats were most likely to say they trusted scientists for information, and Tea Party supporters (strong political conservative force in US) were the least likely (Hamilton et al. 2015). As for health behaviors, political conservatism has been found to be negatively related to vaccine acceptance (e.g., Sarathchandra et al. 2018). Based on this reasoning, we placed political orientation as antecedents of other dimensions such as conspiracy beliefs and attitudes towards the vaccines in our model. It is important to study values in the health care domain as a value reflects a belief in the desirability of a certain end state, and values serve as a guiding principle for selecting or evaluating behaviors.

Research on MFT suggests that the foundation of purity can be a powerful trigger for individual health behavior. Specifically, it can lead to avoidance of perceived bodily contamination, as individuals high in this trait aim to avoid individuals, objects, and experiences that violate sanctity or self-control, or that induce disgust (Clifford and Wendell 2016; Koleva et al. 2012). In the case of vaccines, moral values have been found to be a good predictor of vaccine scepticism (Callaghan et al. 2019; Rutjens et al. 2018). For these reasons, in our model we placed moral purity values as antecedents of other dimensions such as conspiracy beliefs and attitudes towards the vaccines.

Based on the literature presented above, we formulate the following hypotheses:

**Hypothesis 1 (H1).** The political orientation (i.e., being right wing) negatively predicts faith in science (H1a) and positively predicts generalized conspiracy beliefs (H1b) and COVID-related conspiracy beliefs (H1c); moreover, a political orientation negatively predicts both attitudes towards the vaccine (H1d) and attitudes toward COVID-vaccine (H1e).

**Hypothesis 2 (H2).** Moral purity negatively predicts faith in science (H2a), positively predicts both generalized conspiracy beliefs (H2b), and COVID-related conspiracy beliefs (H2c); moreover, moral purity is negatively related to attitudes toward vaccine (H2d) and towards COVID-vaccine (H2e).

**Hypothesis 3 (H3).** Faith in science positively predicts attitudes toward the vaccines (H3a), and the COVID-vaccine (H3b), and negatively predicts conspiracy beliefs (H3c) and COVID-related conspiracy beliefs (H3d); moreover, it is positively related to support for governmental restrictions (H3e) and negatively to the perception of informational contamination (H3f).

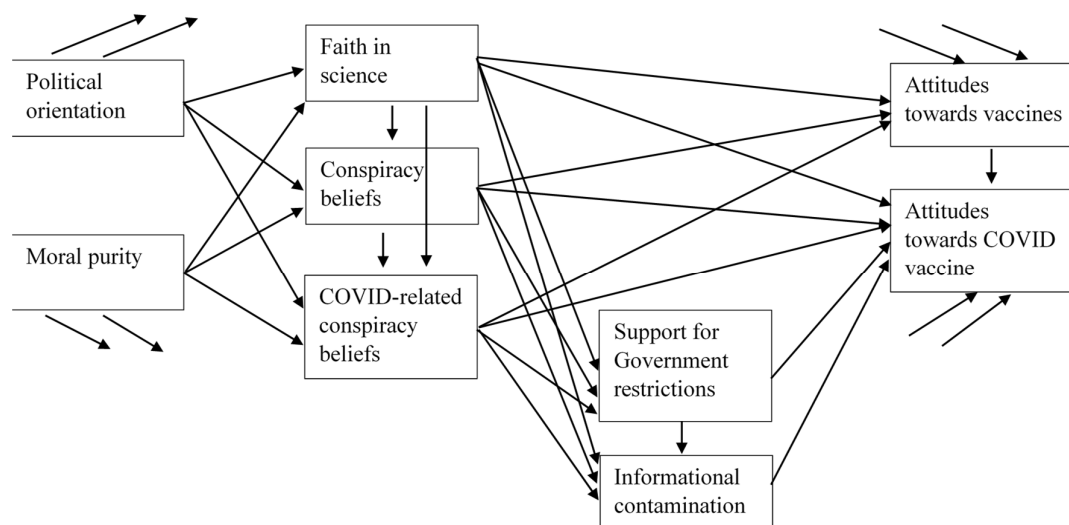
**Hypothesis 4 (H4).** Conspiracy beliefs negatively predict both attitudes towards vaccines (H4a) and towards COVID-vaccines (H4b); moreover, it is negatively related to support for governmental restrictions (H4c) and positively to informational contamination (H4d). Finally, conspiracy beliefs positively predict COVID-related conspiracy beliefs (H4e).

**Hypothesis 5 (H5).** COVID-related conspiracy beliefs follow the same pattern of general conspiracy beliefs; they negatively predict both attitudes towards vaccines (H5a) and towards a COVID-vaccine (H5b); moreover, it is negatively related to support for governmental restrictions (H5c) and positively to informational contamination (H5d).

**Hypothesis 6 (H6).** Support for governmental restrictions positively predicts attitudes towards a COVID-vaccine (H6a); moreover, it negatively predicts the perception of informational contamination (H6b).

**Hypothesis 7 (H7).** The perception of informational contamination negatively predicts attitudes towards a COVID-vaccine .

**Hypothesis 8 (H8).** Attitudes towards the vaccine in general positively relate to attitudes toward a COVID-vaccine.



**Figure 1.** Hypothesized Model 1.

## 2. Methods

### 2.1. Participants

Six hundred Italian participants were involved in the study. Seven participants who self-reported falling sick with COVID-19 and three participants who tested positive without symptoms in the two months before data gathering were subsequently removed to have a homogenous sample with respect to diagnosis. The final sample included 590 participants, 365 females (61.9%; 0.3% who self-declared as non-binary; 1 missing for gender), aged from 18 to 79 years ( $M = 38.3$ ;  $SD = 14.6$ ). Approximately one third of the participants (32.2%) had a high school degree, 13.9% had a bachelor's degree and 48.2% had a master's degree or higher. As for their political orientation, 71.5% positioned themselves on the left of a left-right axis ( $N = 422$ ; from 1 to 3 on the scale), whereas 11.7% on the centre ( $N = 69$ ; point 4 on the scale), and 16.8% on the right ( $N = 99$ ; from 5 to 7).

As for the required sample size, Loadman et al. (1999) indicated considering 10 participants for every free parameter estimated. As we estimated 38 parameters, using that rule we would have needed 380 participants. The size of our sample was above the threshold.

### 2.2. Procedure

The questionnaire was implemented using the Qualtrics.com platform. The questionnaire was open for two weeks during the Italian lockdown, from April 22 until May 8, 2020. Participants were recruited using a convenience sampling strategy (Etikan et al. 2016). The link was sent via email to researchers' and research assistants' contacts. Participants were asked to send the link to other possible participants among both close (e.g., friends) and more distant acquaintances who were over 18 years of age, following a "snowball" procedure (Biernacki and Waldorf 1981) as is common practice in the social sciences (Bornstein et al. 2013). The questionnaire took approximately 20 min on average to fill in.

The research method complies with the norms of the Code of Ethics of the Italian Psychology Association (A.I.P. 2015). Approval was obtained from the Ethical Review Board for Research in Psychology, University of Bologna, in April 2020.

### 2.3. Measures

After providing informed consent, the participants completed an anonymous questionnaire that measured the variables of interest.

Attitudes towards the COVID-vaccine: four items measured the attitudes towards COVID-vaccine (e.g., "If a coronavirus vaccine would be available, I would get a shot immediately"). The response format was a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Items were developed ad-hoc for this study, based on previous literature (e.g., Lewandowsky et al. 2013).

Attitudes towards vaccines: the Short Version of Vaccine Acceptance Instrument (Sarathchandra et al. 2018) was translated into Italian for this study; ten items measured vaccine hesitancy (e.g., "Vaccines are safe"); the response scale ranged from 1 (strongly disagree) to 7 (strongly agree).

Political orientation: the participants' political orientation was assessed on a 7-point scale ranging from 1 (= Left) to 7 (= Right) (Corbetta et al. 2009; Jost 2006; Jost et al. 2003).

Moral purity: three items on moral purity from The Omission as a Compromise on Moral Foundations scale (OC-MF; Di Battista et al. 2020b) measured participants' willingness to neglect their own moral norms in exchange for money, following studies on moral taboo trade-offs (Graham et al. 2009; Graham and Haidt 2012; Tetlock et al. 2000). The response scale measured omissions rather than active behavior, asking participants to state how much money they need to be paid to omit to do a certain behavior (e.g., "To be clean and fresh"), from 1 = I would never agree to do it for money, to 7 = I would agree to do it even for less than 10 Euros.

Faith in science was measured via seven items adapted from Farias et al. (2013) and from Rutjens et al. (2018) (e.g., “Science provides us with better understanding of the universe than does religion”). The response format was a 6-point Likert-type scale ranging from 1 (strongly disagree) to 6 (strongly agree).

Conspiracy beliefs: five items measured conspiracy theory beliefs (ITANES 2016; Mancosu et al. 2017; Lewandowsky et al. 2013) (e.g., “Moon landings never happened and the proof has been fabricated by NASA and the US government”). The response scale ranged from 0 (not plausible at all) to 10 (completely plausible).

COVID-related conspiracy beliefs: five items measured COVID-related conspiracy beliefs (e.g., “The coronavirus has been created artificially in laboratory”). The response scale ranged from 0 (not plausible at all) to 10 (completely plausible). These items were created ad-hoc for this study, based on relevant literature (e.g., Allington et al. 2020; Islam et al. 2020; Jolley and Paterson 2020) and based on brainstorming among the researchers.

Support for governmental restrictions: The Governmental Response to Coronavirus Questionnaire—Restriction scale (Conway et al. 2020) was used to measure how the respondents felt about their government’s response to the crisis and specifically the support for governmental restrictions (e.g., “We need strong government officials right now to take action to stop the spread of disease”). This was composed of two items. The response format was a 7-point Likert-type scale ranging from 1 (definitely disagree) to 7 (definitely agree).

Informational contamination. The Governmental Response to Coronavirus Questionnaire—Informational Contamination Scale (Conway et al. 2020; Conway and Repke 2019) was used to measure the degree that participants felt that they could not trust their governments to provide accurate information during the crisis (e.g., “I distrust the information I receive about the Coronavirus (COVID-19) from my government”). The form was composed of two items. The response format was a 7-point Likert-type scale ranging from 1 (definitely disagree) to 7 (definitely agree).

#### 2.4. Data Analysis

Among the different applications of SEM, a path analysis is a specific multivariate technique which studies the causal relationship between variables and provides a simultaneous explanation of the complex relationships among all the variables (Jöreskog and Sörbom 1996; Jöreskog et al. 2001). In a path model, all of the variables on the left-hand side of the model are logically assumed to have taken place at an earlier stage than any variable found on the right-hand side. The basic idea is that the first variables can influence the subsequent variables and that absence of influence—shown by the absence of a path—means that the last variable did not directly influence the subsequent variable. The strength of the relationships among the latent variables is reflected in the path coefficient, which is the standardized beta coefficient derived from a regression equation predicting the variable at the end of the path.

The LISREL 8.80 software was used to test the SEM (Jöreskog and Sörbom 1996; Jöreskog et al. 2001). The model included two exogenous variables and eight endogenous variables (see Figure 1). Composite scores served as manifest indicators for all the constructs (i.e., moral purity, faith in science, conspiracy beliefs, COVID-related conspiracy beliefs, support for governmental restriction, informational contamination, attitudes towards vaccines, and attitudes towards COVID-vaccine), with the exception of the political orientation which was measured by a single item.

An inspection of Mardia’s (1970) coefficients suggested significant deviations from multivariate normality. As a consequence, we relied on a scaled chi-square and “robust” standard errors using Maximum Likelihood Estimation as suggested by Satorra and Bentler (Satorra–Bentler scaled chi-square, S–B  $\chi^2$ ; Satorra 1988; Satorra and Bentler 1994), which appears to be a good general approach to dealing with nonnormality (Hu et al. 1992; Curran et al. 1996). The goodness of fit was evaluated using the Comparative Fit

Index (CFI; Bentler 1990), Root Mean Square Error Approximation (RMSEA; Browne and Cudeck 1992), the Standardized Root Mean Square Residual (SRMR; Bentler 2007) and the Normed Fit Index (NFI; Bentler and Bonett 1980). To evaluate mediation, we followed the procedure suggested by Preacher and Hayes (2004).

### 3. Results

#### 3.1. Preliminary Analyses

Descriptive statistics, reliabilities, and correlations between the scales are provided in Table 1. An inspection of reliability indexes revealed that the Pearson’s *r* values were significant, and Cronbach’s alphas were all above 0.78, with the exception of moral purity (0.58). The poor alpha of moral purity measure is in line with previous research (e.g., Di Battista et al. 2020b; Graham et al. 2011). Specifically, this poor alpha could be due to the content of the items, which have been originally formulated/chosen to cover a wide range of morally relevant situations using a small number of items (Bobbio et al. 2011). The skewness and kurtosis were all below |2| indicating a normal distribution of the data, with the exception of the kurtosis of moral purity.

The results indicated that on average participants had strong faith in science, were supportive of vaccines in general and of a COVID-vaccine specifically. In line with this, the participants had low scores for conspiracy beliefs and COVID-related conspiracy beliefs. Moreover, the participants were supportive of restrictive measures implemented by the Italian government during the pandemic and did not perceive that the information they received from the media was contaminated.

We ran a series of *t*-test with gender as the independent variables to test whether male and female participants differed in terms of measured variables. Male participants showed:

- more faith in science ( $M = 4.45, SE = 0.06$ ) compared to female participants ( $M = 4.22, SE = 0.05$ ). This difference,  $0.23, BCa\ 95\% CI (0.06, 0.40)$ , was significant  $t(585) = 2.73, p = 0.006, d = 0.24$ ;
- weaker support for governmental restrictions during the pandemic ( $M = 5, SE = 0.11$ ) compared to female participants ( $M = 5.47, SE = 0.08$ ). This difference,  $-0.46, BCa\ 95\% CI (-0.75, -0.2)$ , was significant  $t(585) = -3.44, p = 0.001, d = 0.29$ .
- lesser endorsement of purity moral values ( $M = 5.77, SE = 0.09$ ) compared to female participants ( $M = 6.33, SE = 0.05$ ). This difference,  $-0.57, BCa\ 95\% CI (-0.77, -0.35)$ , was significant  $t(585) = -5.94, p < 0.001, d = 0.41$ .

The correlations were all significant and in the expected direction, with the exception of the correlation between support for governmental restrictions and the political orientation, and between support for governmental restrictions and moral purity. Additionally, informational contamination was unrelated to moral purity. As expected, the attitudes toward the COVID-vaccine were more strongly related to attitude toward the vaccines in general, whereas they were negatively correlated with conspiracy beliefs, COVID-related conspiracy beliefs, and informational contamination.

**Table 1.** Descriptives and Pearson’s correlations among the variables.

Study Variables	M (SD)	Range	Cronbach’s Alpha	Skewness	Kurtosis	1.	2.	3.	4.	5.	6.	7.	8.
1. Political orientation	3.08 (1.3)	1–7	-	0.88	-0.1	-							
2. Moral purity	6.13 (1.15)	1–7	0.58	-1.62	2.64	0.13**	-						
3. Faith in science	4.30 (1)	1–6	0.82	-0.47	-0.11	-0.23**	-0.20**	-					
4. Conspiracy beliefs	3.49 (2.06)	1–11	0.78	0.83	0.23	0.27**	0.09*	-0.31**	-				



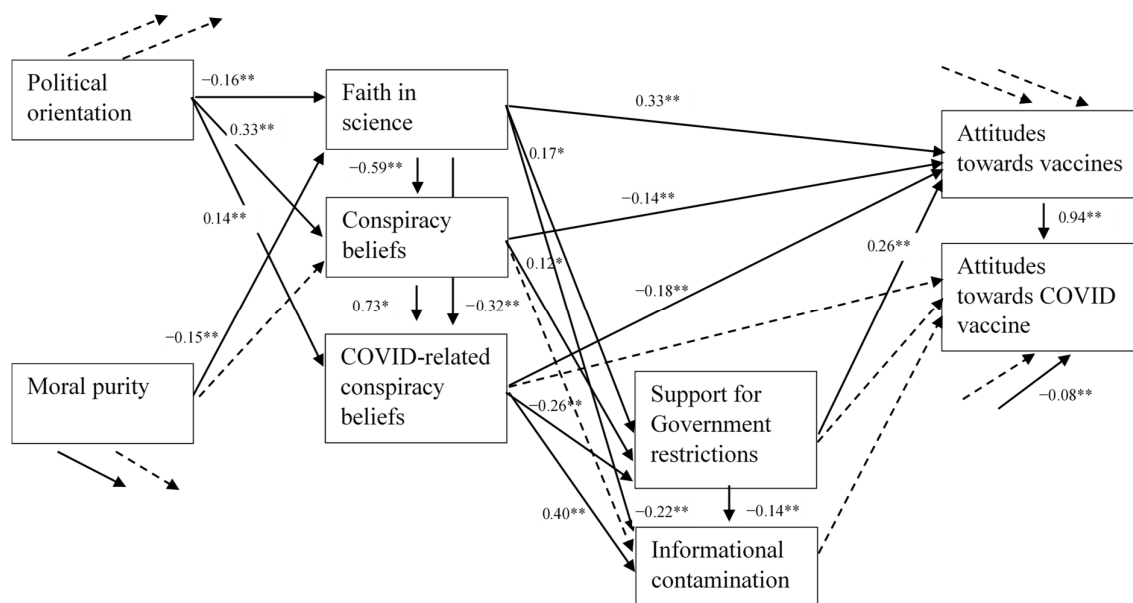
5. COVID-related conspiracy beliefs	2.83 (2.19)	1-10.8	0.86	1.43	1.57	0.31**	0.13**	-0.37**	0.75**	-			
6. Support for Governmental restrictions	5.29 (1.58)	1-7	r = 0.37**	-0.89	0.15	-0.07	0.03	0.18**	-0.15**	-0.27**	-		
7. Informational contamination	2.9 (1.68)	1-7	r = 0.62**	0.79	-0.15	0.33**	0.04	-0.36**	0.52**	0.65**	-0.30**	-	
8. Attitudes towards vaccines	5.48 (1.37)	1-7	0.92	-1.46	1.81	-0.22**	-0.08*	0.44**	-0.54**	-0.61**	0.44**	-0.50**	-
9. Attitudes towards COVID-vaccine	5.45 (1.72)	1-7	0.93	-1.12	0.39	-0.20**	-0.13**	0.40*	-0.50**	-0.58**	0.42**	-0.49**	0.81**

Note: M = Mean, SD = Standard Deviation, r = Pearson correlation coefficient, \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

### 3.2. Structural Equation Modelling

The hypothesized model was tested using SEM. Examination of fit indices showed a good fit between the proposed model and the data ( $S-B\chi^2(8) = 93.533, p < 0.001, CFI = 0.973; RMSEA = 0.135; NFI = 0.971, SRMR = 0.0529$ ). In this model, paths from faith in science to attitudes towards COVID-vaccine and from conspiracy beliefs to attitudes towards COVID-vaccine were fixed to 0 (not supporting  $H_{3b}$  nor  $H_{4b}$ ), given their t-values were less than |2|.

An inspection of the modification indexes suggested that the model could be improved by adding a path from support for governmental restrictions to the attitude towards vaccines (modification index = 85.713). After adding this path, the fit indexes improved accordingly ( $S-B\chi^2(7) = 23.116, p = 0.002, CFI = 0.995; RMSEA = 0.063; NFI = 0.993, SRMR = 0.023$ ). The final model is shown in Figure 2.



**Figure 2.** Model 2. Note. All variables were correlated. All of the coefficients were unstandardized. All the coefficients associated with solid lines were significant, while those associated with dashed lines were not significant beyond the  $p < 0.05$  level. \*  $p < 0.05$ ; \*\*  $p < 0.001$

The political orientation negatively predicted faith in science ( $\beta = -0.22$ ) with those being more right-wing having less faith in science, and the same aspect positively predicted both conspiracy beliefs ( $\beta = 0.21$ ) and COVID-related conspiracy beliefs ( $\beta = 0.09$ ) with those being more right-wing endorsing more conspiracy beliefs in general and conspiracy beliefs related to the spread of COVID (totally supporting H<sub>1</sub>).

Endorsing moral purity values predicted less faith in science ( $\beta = -0.18$ ) and stronger negative attitudes towards COVID-vaccines ( $\beta = -0.06$ ) (supporting H<sub>2a</sub> and H<sub>2e</sub>) but was unrelated to attitudes towards vaccines in general (not supporting H<sub>2a</sub>), conspiracy beliefs and COVID-related conspiracy beliefs (not supporting H<sub>2b</sub> nor H<sub>2c</sub>).

Faith in science negatively predicted general ( $\beta = -0.28$ ) and COVID-related conspiracy beliefs ( $\beta = -0.14$ ), with those believing more in science also less endorsing general and COVID-related conspiracy beliefs (in line with H<sub>3c</sub> and H<sub>3d</sub>). Faith in science positively predicted support for governmental restrictions ( $\beta = 0.10$ ), and negatively predicted the perception of informational contamination ( $\beta = -0.13$ ), with those more supporting science being also more in favor of government restrictions and less willing to believe that the information they receive from the government about the COVID was contaminated (supporting H<sub>3e</sub> and H<sub>3f</sub>). Finally, faith in science strongly predicted a positive attitude toward vaccines ( $\beta = 0.23$ ), with those supporting science being also more positive about vaccines (in line with H<sub>3a</sub>).

Conspiracy beliefs positively predicted COVID-related conspiracy beliefs ( $\beta = 0.69$ ), with those endorsing more conspiracy theories in general endorsing also COVID-related conspiracy beliefs, such as that COVID has been spread intentionally to damage the economies of certain countries (in line with H<sub>4e</sub>). Conspiracy beliefs positively predicted support for governmental restrictions ( $\beta = 0.15$ ) with those endorsing more conspiracy theories being also more supportive of restrictions promulgated by the government during the pandemic (in contrast with H<sub>4c</sub>). Conspiracy beliefs negatively predicted attitudes toward vaccines ( $\beta = -0.22$ ), with those endorsing more conspiracy theories being also less positive about vaccines (in line with H<sub>4a</sub>). This did not predict informational contamination (not supporting H<sub>4d</sub>).

COVID-related conspiracy beliefs negatively predicted support for governmental restrictions ( $\beta = -0.35$ ) and positively predicted the perception of informational contamination ( $\beta = 0.53$ ), with those endorsing more COVID-related conspiracy beliefs being also less supportive of governmental restrictions and trusting less their government to provide accurate information during the crisis (in line with H<sub>5c</sub> and H<sub>5d</sub>). COVID-related conspiracy beliefs negatively predicted attitudes towards vaccines ( $\beta = -0.29$ ), with those sharing more COVID-related conspiracy theories being also less in favor of vaccines (in line with H<sub>5a</sub>). However, COVID-related conspiracy beliefs did not directly predict attitudes towards COVID-vaccines (not supporting H<sub>5b</sub>).

Support for governmental restrictions was negatively related to the perception of informational contamination ( $\beta = -0.14$ ) (supporting H<sub>6b</sub>) and positively related to attitudes towards vaccines ( $\beta = 0.31$ ), with those supporting the governmental provisions trusting their government more to provide accurate information in times of crisis and being more in favor of vaccines. However, support for government restrictions and informational contamination during the pandemic did not predict attitudes towards COVID-vaccines (not supporting H<sub>6a</sub> and H<sub>7</sub>).

As expected, attitudes towards the vaccine were positively related to attitudes towards COVID-vaccines ( $\beta = 0.75$ ), with those being in favor of vaccines in general, being also more supportive of COVID-vaccines (supporting H<sub>8a</sub>).

Finally, we examined the mediating role of the attitudes towards the vaccines between COVID-related conspiracy beliefs and attitudes towards COVID vaccine. Since

MacKinnon et al. (2002) have shown that the method used by LISREL to calculate the standard error of the indirect effect tends to yield incorrect estimates, we followed the procedure suggested by Preacher and Hayes (2004), combining normal theory approach developed by Sobel (1982), bootstrap approach and traditional approach advocated by Baron and Kenny (1986).

In Step 1 of the mediation model, the regression of COVID-related conspiracy beliefs on attitudes towards COVID vaccine, ignoring the mediator, was significant,  $b = -0.46$ ,  $t(588) = -17.33$ ,  $p < 0.001$ . Step 2 showed that the regression of COVID-related conspiracy beliefs on the mediator, attitudes towards the vaccine, was also significant,  $b = -0.38$ ,  $t(588) = -18.57$ ,  $p < 0.001$ . Step 3 showed that the mediator (attitude towards the vaccine), controlling for COVID-related conspiracy beliefs, was significant,  $b = 0.90$ ,  $t(587) = 24.05$ ,  $p < 0.001$ . Step 4 of the analysis revealed that, controlling for the mediator, COVID-related conspiracy beliefs were still significant predictors of attitudes towards COVID vaccine,  $b = -0.11$ ,  $t(587) = -4.74$ ,  $p < 0.001$ . We tested the significance of this indirect effect using bootstrapping procedures. The indirect effect reflects the amount by which the total effect of the independent variable (i.e., COVID-related conspiracy beliefs) is decreased when the mediator (i.e., attitudes towards the vaccine) is introduced in the analysis. An Indirect Effect is significant when its confidence interval does not cross zero. The bootstrapped unstandardized indirect effect was  $-0.35$ , and the 95% confidence interval ranged from  $-0.41$  to  $-0.29$ . Thus, the indirect effect was statistically significant. A Sobel test confirmed the mediation in the model ( $z = -14.69$ ,  $p < 0.001$ ).

#### 4. Discussion

The availability of a COVID-vaccine does not automatically imply it will be used. This study shed some light on the role played by faith in science and (COVID-related)-conspiracy beliefs, their antecedents such as the political orientation and the endorsement of purity values, on the willingness to take a COVID vaccine. Via SEM, the data showed that faith in science positively and conspiracy beliefs negatively directly predicted attitudes towards the vaccine. However, they did not directly predict attitudes towards a COVID-vaccine. Attitudes towards the vaccine in general mediated the relationship between COVID-related conspiracy beliefs and attitudes towards COVID-vaccines (e.g., Bertin et al. 2020; Earnshaw et al. 2020; Romer and Jamieson 2020), indicating again the importance of this dimension in predicting the acceptance of a COVID-vaccine. This result confirms previous research showing that health engagement was positively related to the intention to vaccinate and this relationship was partially mediated by the general attitude towards vaccines (Graffigna et al. 2020).

In general, those results are in line with the relevant literature. Specifically, the link between conspiracy beliefs unrelated to the health domain (e.g., the “fake” landing on the Moon) and the unwillingness to get vaccinated have been found in previous studies suggesting that anti-vaccination beliefs are part of a psychological propensity to believe in conspiracies (e.g., Goldberg and Richey 2020). As expected, conspiracy beliefs were inversely related to trust in science, which is also consistent with the relevant literature (e.g., Rutjens et al. 2018). Taken together, these results suggest that conspiracy beliefs may present a substantial public health risk, as they were found to be inversely related to reduced compliance with public health guidance with regard to COVID-19, such as staying at home, keeping 2 m distance and prolonged washing hands (Allington and Dhavan 2020).

As for the antecedents of belief in conspiracy theories, political orientation predicted faith in science, non-health related belief in conspiracy theories and COVID-related belief in conspiracy theories in the expected direction. More right-wing participants showed less faith in science and more willing to endorse both kinds of conspiracy beliefs, in line with the Italian study by Mancosu et al. (2017). However, the political orientation did not predict attitudes towards the (COVID-) vaccine, in line with Engin and Vezzoni (2020), calling for a deeper analysis of the specific Italian political situation. We argue that due to the increasing fragmentations of the political scene into small parties and unstable alliances

between parties in Italy, other dimensions such as moral values increased in importance in people's personal political orientations and became more significant indicators for political decision-making than traditional ones (such as status, education, and occupation; Caprara et al. 2006; Lakoff 2004; Vecchione et al. 2011).

Consistent with this idea, in our model moral purity directly predicted negative attitudes towards the COVID-vaccine, with those participants considering purity to be an important moral value being also less in favor of the vaccine. Endorsement of moral purity conveys an idea of respect for the integrity of the body and vaccinations could be seen as corrupting the sacredness of the body (e.g., Di Battista et al. 2020b). This reasoning is also in line with antivaccination attitudes as highest among those who reported high levels of disgust toward blood and needles (Hornsey et al. 2018).

As for the role played by the governmental response to the pandemic, only support for government restrictions was positively related to COVID-vaccines. Again, this data suggests the need to better investigate the role of health-related attitudes in shaping support for COVID-vaccines.

We believe that one novelty of this study lies in the proposed causal model, which has confirmed the hypothesized relationships between study variables. While some studies have explored public compliance with health-related guidance during the COVID pandemic (e.g., Allington and Dhavan 2020) or the relationship between conspiracy beliefs and support for COVID vaccines (e.g., Bertin et al. 2020), this study provides a broader causal model, incorporating at the same time both antecedents and consequences of conspiracy beliefs and predicting attitudes toward COVID vaccines during the first Italian lockdown. For instance, support for a COVID vaccine was not just a matter of specific attitudes but it was found to be related to the more general attitude toward vaccines.

Given that the media play a crucial role in spreading health-related information and influencing health-related behavior, future studies could monitor media coverage on key healthcare topics such as the COVID-vaccine during the pandemic. Moreover, the social media and Internet play a pivotal role in both fostering and spreading conspiratorial beliefs. For instance, Allington et al. (2020) found a positive relationship between COVID-19 conspiracy beliefs and the use of social media as a source of information about COVID-19. Future research should explore this issue also in the Italian context (e.g., in Poland, see Duplaga 2020).

Moreover, as the perceived morality of the authorities influences conspiracy beliefs, particularly when people experience uncertainty (Van Prooijen and Jostmann 2013), future research could explore the role that perceptions of morality of the source of information play in reducing/fostering conspiracy beliefs (e.g., Di Battista et al. 2020a).

#### 4.1. Study Limitations

First of all, even if convenience sampling is commonly used in social sciences (Bornstein et al. 2013), we are aware that the use of this procedure also means that our sample was not necessarily representative of the Italian population in general. For instance, our sample was slightly more left-wing, younger, and more educated than the average population. Future research should involve a more balanced and more representative sample of the population. However, a strength of our study was the data-gathering: we did not recruit only university students, but we collected data from the general population by spreading and advertising the questionnaire via multiple methods such as social networks, email, mailing lists, etc.

Additionally, as we collected data via online questionnaires, it is possible that the participants were self-selected because older citizens and/or those less familiar with social media did not fill in the questionnaire. However, to overcome this problem, we sent the link to the questionnaire also via WhatsApp and instant messaging to both close friends and distant acquaintances, trying to also reach the less reachable participants. Moreover, the willingness to fill in a questionnaire is often dependent on the perceived importance of the topic to the participants' personal experiences. We consider attitudes toward the

COVID-vaccine during the first Italian lockdown as a relevant issue for the participants, who were experiencing strong limitations to their personal freedom and civil liberties in favor of the collective good, i.e., a reduction in the spread of the disease.

Moreover, as our data were collected during the first wave when there was almost no information on the availability and the type of COVID-vaccine, we must acknowledge that our results are highly time- and context-specific. It is likely that during the years 2020 and 2021 the perceptions of COVID-vaccines may have changed. However, addressing the question of changing perceptions would require a longitudinal approach which goes beyond the scope of our current study.

It is worth mentioning that two measures, namely, COVID-related conspiracy beliefs and attitudes towards COVID vaccines, were developed ad-hoc for this study based on relevant literature and were not previously validated. However, in the study, we provided reliability measures in terms of Cronbach's alpha. Additionally, correlations between the study variables were all in the expected direction, with the exception of moral purity and faith in science for which a positive relation was expected. Future research is needed to replicate these findings with different more validated measures.

#### 4.2. Practical Implications

This study serves to reinforce previous findings on attitudes towards vaccines in general and serves as a pilot for future investigation into the impact of these factors on attitudes towards the COVID-vaccine at a population level. Knowing more about psychosocial determinants of COVID-19 vaccine hesitancy can help government agencies, health care workers and other authorities to mitigate the impact of vaccine scepticism. For instance, it might involve addressing the issue of conspiracism and also developing public information campaigns designed to reduce vaccine avoidance by increasing confidence in the effectiveness and safety of the vaccine (Thunström et al. 2020).

To reduce the detrimental consequences of conspiracy beliefs, it was found that exposure to anti-conspiracy arguments both before and after exposure to conspiracy theories can restore the vaccination intention (Jolley and Douglas 2017; Lyons et al. 2019). Moreover, an experimental study revealed that providing rational arguments was an effective strategy, along with providing ridiculing arguments, in the reduction of conspiracy beliefs. Considering the benevolent effects of analytic thinking in conspiracy belief reduction, uncovering arguments regarding the logical inconsistencies of conspiracy beliefs can be an effective way to discredit them (Orosz et al. 2016). Additionally, pre-existing knowledge about the HPV vaccine was found to reduce the impact of exposure to anti-vaccine conspiracy theories on the HPV vaccination intention (Chen et al. 2020).

## 5. Conclusions

In conclusion, our results are congruent with past research and suggest that when a vaccine against COVID-19 becomes available, faith in science and inversely conspiracy beliefs of all kinds might play a role in the reduction in the population immunization. Moreover, in our study attitudes towards COVID vaccine were rooted in the more general attitudes towards vaccines, and in this sense some efforts have to be put into strengthening trust in vaccination, as this would in turn foster a more positive attitude toward COVID vaccine specifically. This should encourage academics, policy makers, health authorities, and journalists to start working on initiatives to tackle this issue, including spreading convincing evidence and clear communication on the safety and effectiveness of vaccines.

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