



Believing in conspiracy theories in Spain during the COVID-19 pandemic: Drivers and public health implications

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ABSTRACT

Conspiracy theories jeopardize public health by disseminating misinformation and undermining authoritative health guidelines. This study explores social factors associated with the belief in conspiracy theories in Spain during the COVID-19 pandemic. Drawing upon the theoretical framework of Max Weber, it posits that beliefs in conspiracy theories are linked to both instrumental rationality considerations, such as trust in health authorities, science, and pharmaceutical companies, as well as value-rationality based factors, such as ideological orientation. The study analyzes recent, nationally representative survey data and is the first to examine the social predictors of belief in conspiracy theories in Spain during the pandemic. The findings highlight that conspiracy theory beliefs are (a) associated with considerably worse vaccination behaviors, (b) not or only very weakly associated with standard demographics such as age, sex, or education, (c) related to instrumental rationality considerations, and (d) only weakly related to value-rationality indicators such as ideological and religious affiliations. In conclusion, the study underscores the significance of public health policies that specifically address conspiracy theory convictions, and to that end, advocates for the application of a Weberian sociological perspective to better understand the diverse rationalities underlying these beliefs, particularly in the absence of discernible demographic predictors.

1. Introduction

Conspiracy theories are of utmost significance for academic inquiry, given the far-reaching impact these theories have had on public health, trust in institutions, and political and social discourse. Various studies illustrate a positive correlation between the acceptance of conspiracy theories and the reluctance to receive vaccinations (Bertin et al., 2020; Milosevic Dordevic et al., 2021; Romer and Jamieson, 2020; Van Oost et al., 2022; van Prooijen et al., 2021). Accordingly, examining the psychological, cultural, and political factors that contribute to the formation and spread of conspiracy theories is critical for developing effective strategies to counter misinformation and promote evidence-based knowledge, rational decision-making, and public health. This research contributes to the scholarship by exploring social factors that are associated with the belief in conspiracy theories in Spain during the COVID-19 pandemic, which will help to comprehend the societal

predictors of this phenomenon and generate insights that can inform policy, practice, and public knowledge.

To that end, the study analyzes nationally representative survey data from Spain and contributes to the academic literature on conspiracy theories in two significant ways. To start with, it is the first study to examine the social predictors of belief in conspiracy theories in Spain in the pandemic period using nationally representative survey data. This is particularly crucial given recent research by Gualda et al. (2021) revealing a link between conspiracy theory beliefs about COVID-19 and decreased adherence to health authority-recommended social distancing measures in Spain (also see Romero Reche, 2023). Consequently, it is vital to identify social factors associated with these beliefs. Secondly, the article introduces a new theoretical perspective based on Max Weber's sociological framework to elucidate the social factors underpinning conspiracy theory beliefs. This perspective allows for the identification and classification of values and instrumental calculations

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that drive these beliefs. Thus, the study presents a novel sociological perspective for examining the significance of conspiracy theories beyond the COVID-19 period and Spain.

Drawing upon the theoretical framework of Max Weber, this research posits that beliefs in conspiracy theories are linked to both instrumental factors, such as trust in health authorities, science, and pharmaceutical companies, as well as value-based factors, such as religious affiliation and ideological orientation. The present study commences by expounding upon the theoretical framework, its hypotheses, and its contributions to the existing scholarship on conspiracy theories. Subsequently, the article describes the data and methods employed in the analysis, followed by the presentation of the study's findings. Finally, the article concludes by discussing the implications of the findings in relation to the broader research on conspiracy theories.

2. Understanding conspiracy theories sociologically

Various forms of reasoning may impact individuals' inclination to endorse conspiracy theories. For example, individuals may adhere to specific religious doctrines that foster a deep-seated suspicion of particular societal factions, thus increasing their susceptibility to conspiratorial narratives about said groups. As such, a thorough evaluation of the perception and acceptance of conspiracy theories should consider the interplay of multiple modes of reasoning. From a sociological standpoint, this article adopts Max Weber's theoretical framework of rationalization to attain a more nuanced understanding of this phenomenon. Weber identifies four types of rationality: formal, theoretical, practical, and substantive. Formal rationality denotes the utilization of means-to-end calculations through universally applicable rules and regulations. This type of rationality follows a logical structure that organizes and combines all the relevant components. For example, according to Weber (1978), laws are created through a consistent and methodical process, demonstrating uniformity and therefore are a result of formal rationality. Theoretical or intellectual rationality involves individuals' efforts to achieve a coherent comprehension of reality through abstract cognitive processes (Kalberg, 1980). According to Weber (2009), religious ethics are the outcome of this process, as the intellectual endeavor to ascribe significance to the cosmos has precipitated the emergence of ethical frameworks grounded in religion. Weber's (2001) practical rationality describes individuals' instrumental and pragmatic analyses to cope with everyday problems. Weber (2009) cites merchants as probable daily practitioners of practical rationality, as they often need to evaluate everyday situations pragmatically. Finally, substantive or value rationality denotes people's comprehension of reality based on the values they uphold, such as religious dogmas.

The four types of rationality can also intersect or reinforce one another. Boudon's (2003, 2008) cognitivist theory of action acknowledges the importance of value postulates alongside instrumental rationality in shaping human decision-making. Boudon (2008) conducted an experiment to explore the interplay between substantive and instrumental rationality. The experiment simulated a scenario in which a hardware store raised the prices of snow shovels following a heavy snowstorm. The respondents were asked for their opinions on the price hike, and most of them viewed it as unjust. In discussing this experiment, Boudon (2008) emphasized how people's values influenced their rational interpretation of the situation: while they might have accepted the price increase under normal conditions as an instrumental application of formal rationality in the market economy, their values of human solidarity led them to take the opposite stance. Similarly, Woods (2001) postulates that practical and substantive rationality can intersect, leading individuals to develop a moral and ethical understanding of the world that may be reinforced, challenged, or enhanced by instrumental rationality. Both Boudon's and Woods' discussions illustrate how individuals' values can shape their rational interpretation of events and how instrumental rationality can either reinforce or challenge these values and vice versa.

This study employs the Weberian theory of rationality to investigate the social determinants of belief in conspiracy theories. It is important to note that Weber's theoretical and formal rationalities have limited impact on individuals' day-to-day social actions, as people tend to rely on practical and substantive rationalities when making everyday decisions (Kalberg, 1980). While theoretical and formal rationalities pertain to structured viewpoints like religion and legal systems, value and instrumental rationalities encompass individuals' everyday comprehension of reality. In the context of our study aiming to elucidate how people perceive conspiracy theories using survey data, our analysis predominantly revolves around the lenses of value and instrumental rationalities. Indeed, when individuals encounter a conspiracy theory, they would be more likely to assess it based on their personal values and practical reasoning, rather than viewing it as an element contributing to the establishment of a logically structured worldview of formal rationality or as an endeavor to attain a coherent understanding of reality through abstract cognitive mechanisms, as expounded by theoretical rationality (Romero Reche and Nefes, 2022).

The research proposes that individuals' predispositions towards value-laden and instrumentally rational behaviors may predict their inclination to believe in conspiracy theories. Through instrumental rationality, individuals may endorse conspiracy theories that align with their pragmatic interests; for instance, if a conspiracy theory targets their political opponent, they may support it without necessarily believing in it. Numerous studies have found that political party partisanship is a significant predictor of conspiracy theory beliefs (Albertson and Kimberley, 2020; Douglas et al., 2019; Enders and Smallpage, 2019; Enders et al., 2020; van der Linden et al., 2021; Miller et al., 2016; Nefes, 2013, 2014, 2015, 2017; Pasek et al., 2015; Saunders, 2017; Siddiqui, 2020; Smallpage et al., 2017; Uscinski et al., 2016). Additionally, individuals may be attracted to conspiracy theories because of the social, ethical, or religious values they hold: Mancosu et al. (2017) found a positive correlation between belief in conspiracy theories in Italy and higher levels of religiosity, while Nyhan and Zeitzoff (2018) discovered a strong link between belief in conspiracy theories and anti-Western and anti-Jewish values in the Middle East and North Africa.

The literature on COVID-19 conspiracy theories also reveals factors that could be explained by a combination of instrumental and value rationality. Specifically, institutional trust to authorities and science, which can be seen functions of instrumental rational thinking, could inform people's interpretations of conspiracy theories about COVID-19 (Achimescu et al., 2021; Bruder and Kunert, 2022; Kim and Kim, 2021; Rutjens et al., 2021; Eshel et al., 2022). Furthermore, Syropoulos and Gkinopoulos (2023) found that institutional trust and conspiracy theory beliefs predict vaccine hesitancy even after accounting for demographic variables. In other words, instrumental thinking about the source of information can influence people's perceptions. Meanwhile, values, such as political ideology (Koon et al., 2021; Stoler et al., 2022; Uscinski et al., 2020) and religiosity (Kim and Kim, 2021; Seddig et al., 2022), may predict an individual's tendency to believe in these conspiracy theories. Kimhi et al. (2022) associate institutional trust and level of religiosity with COVID-19 vaccine hesitancy and uptake. Romer and Jamieson (2021) argue that conservative media outlets in the United States attract individuals predisposed to conspiratorial thinking and conservative political views. By selectively consuming these media outlets, these individuals become more likely to endorse COVID-19 conspiracy theories. In Spain, right-wing respondents were more likely to agree with COVID-19 specific conspiracy theories than with general conspiracy theory beliefs according to a recent online survey (Galais and Guinjoan, 2022). This should not be surprising, as the Socialist Party, which led the left-wing coalition government during the pandemic, had been the object of right-wing conspiracy theories during the first decade of the 21st century (Garcia Tojar, 2010). Moreover, a study analyzing the discourse of the Spanish far-right party Vox on social media during the pandemic shows how COVID-19 conspiracy theories were promoted by its representatives in the Spanish Parliament through their Twitter

accounts (Badajoz-Davila et al., 2023). Hence, ideological orientation could be associated with the beliefs in conspiracy theories in Spain.

The Weberian model, as an exploratory framework, may present limitations in its capacity to explain the impact of the conspiracy mindset, which could be defined as a predisposition to embrace conspiracy theories as explanatory frameworks, and the dynamics underlying shifts in the endorsement of conspiracy theories. Pierre (2020) contends that the conspiracy mindset possesses the potential to render individuals more susceptible to misinformation. This arises when individuals lose faith in authoritative figures, engendering a circumstance wherein a dearth of dependable knowledge prompts them to seek solutions in unconventional narratives, such as conspiracy theories. Concurrently, Romer and Jamieson (2022) procured corroborative evidence indicating that an inclination towards conspiratorial thinking during 2019 exhibited a heightened predictive capacity for vaccine hesitancy pertaining to COVID-19 in 2021, surpassing the influence of prior confidence in health care authorities or the assimilation of deceptive vaccine-related information. Our sociological interpretation, anchored in a Weberian conceptualization of rationality, complements such findings and enables further elaboration by exploring the instrumental and value-rational tendencies of individuals harboring a conspiracy mindset. It could also facilitate an examination of alterations in conspiracy theory convictions or the conspiracy mindset. To illustrate, an individual possessing a conspiracy mindset and simultaneously upholding staunch support for the Spanish government might find themselves disinclined towards embracing COVID-19 conspiracy theories at odds with governmental policies. The Weberian framework offers a nuanced vantage point, allowing us to delve into such shifts with an in-depth perspective. This exploration could contribute to the development of effective countermeasures against the conspiracy mindset.

In terms of hypotheses, this study uses Weberian theoretical perspective to suggest that people's instrumental reasoning, specifically their assessment of the credibility of health authorities, science, and pharmaceutical companies, may shape their beliefs in conspiracy theories (H1). Given that trust is grounded in a cognitive and rational assessment of the trustee's instrumental interests (Coleman, 1990; Hardin, 2002), this study examines the association between trust in relevant institutions and conspiracy-theory beliefs as a manifestation of instrumental thinking. Furthermore, to explore the significance of value-rational thinking on conspiracy-theory beliefs, this study investigates the association between conspiracy-theory beliefs and religious affiliation and ideological orientation (H2).

H1. The tendency to believe in a conspiracy theory will be higher if the theory is congruent with one's lack of trust to health authorities in Spain, science and pharmaceutical companies

H2. The tendency to believe in a conspiracy theory will be higher if the conspiracy theory is congruent with values associated with religious affiliation and ideological orientation.

3. Methods and data

This study analyzes a recent survey conducted by the Fundación Española para la Ciencia y la Tecnología (FECYT) that provides large-scale evidence of the belief in conspiracy theories in Spain (FECYT, 2022). The survey was conducted between 19 November and 7 December 2021 and collected interviews of a nationally representative sample of 2100 individuals who reside in Spain for five years or more and are 18 years of age or over. The survey collected information through computer-assisted telephone interviews (CATI), using a structured and pre-coded questionnaire. To ensure representativeness of the data for the Spanish population, a stratified random sample was drawn. Strata were defined by an intersection of community size and the fifty provinces of Spain, to provide an even representation of participants across the country. Our study was exempt from ethical review, as it only entails secondary analysis of publicly available data.

3.1. Outcome variable conspiracy beliefs

Our outcome variable conspiracy theory beliefs is based on seven items shown in Table 1. For each item, participants were given seven response options ranging from 'Disagree' to 'Agree,' and as can be seen from the Table, there is considerable variance in responses. Some items, such as 'There are secret organizations that greatly influence political decisions,' tap at general conspiracy theory beliefs, only one, 'The origin of the coronavirus is not natural, it was developed in a laboratory,' was specific to COVID-19. Full agreement with the items varies between five (for 'Vaccinating children is harmful, and this fact is hidden') and 22 per cent, for the COVID-19 lab origin item.

To explore if the seven items all measure one common dimension, we conducted a principal component analysis of the items. Indeed, the principal component analysis yields a one-dimensional solution which explains 67% of the variance. Factor loadings are shown on the right-hand side of Table 1. To assess the reliability of the conspiracy theory belief measure, we calculated Cronbach's alpha, which is 0.90 across the seven items, indicating high internal consistency. By calculating the average across the seven items (for all individuals who gave a valid response to at least one of the seven items) and standardizing the resulting score to have a mean of zero and a standard deviation of 1, we obtain the measure shown in Panel A of Fig. 1. High values on the resulting outcome variable indicate stronger conspiracy theory beliefs.

To assess the real-life relevance of the conspiracy theory beliefs measure, we explored its association with self-reported vaccination behaviors, shown in Panel B of Fig. 1. Participants with stronger beliefs in conspiracy theories are indeed less likely to be vaccinated against covid-19. Among those with the weakest beliefs in conspiracy theories (-2 standard deviations) the predicted probability of being vaccinated is 0.996, among those with the strongest beliefs ($+2$ SD), it is only 0.830. The same pattern holds for the participants' 12–17 year-old children, decreasing from 0.986 to 0.770. The fact that the conspiracy theory beliefs measure predicts participants' vaccination decisions demonstrates that believing in conspiracy theories has important behavioral consequences.

3.1.1. Predictor variables instrumental rationality

To gauge instrumental rationality considerations of the participants, we draw on four survey items. *Trust in government health authorities* is measured with the item 'I am completely sure that the coronavirus vaccines recommended by the health authorities are safe.' *Trust in pharmaceutical companies* is measured with the item 'The economic interest of pharmaceutical companies harms the health management of the coronavirus' (reversed). *Trust in science* is measured with the following items: 'Scientific knowledge is the best basis for making laws and regulations' (referred to as trust in science I) and 'To what extent do you trust that national scientific and medical advisers know the best measures to deal with the pandemic?' (reversed, referred to as trust in science II). Response options are measured on seven-point scales, and we reversed two items (as indicated above) to ensure that higher values indicate greater trust. We refrained from creating a scale out of the two items due to their low Pearson correlation ($r = 0.04$).

3.1.2. Predictor variables value rationality

To gauge value rationality considerations, we consider participant's religious affiliation, distinguishing between practicing (21%) and non-practicing Catholics (41%), those who declare themselves to be indifferent (19%), atheists (15%), as well as those who declare themselves to be members of other religions (1%, $n = 21$). While participants were requested to specify in the interview which 'other' religion they are members of, this information is not included in the publicly available data file, likely to protect respondents' privacy. Further, we examine participant's *political ideology* as measured on a seven-point left-right scale, where 1 denotes 'extreme left' and 7 'extreme right.'

Table 1
Conspiracy theory belief items: Item wording, descriptive statistics, and factor loadings.

	Mean	SD	Histogram	Loading	Uniqueness
There are secret organizations that greatly influence political decisions	4.62	1.70		0.718	0.484
The origin of the coronavirus is not natural, it was developed in a laboratory	4.90	1.78		0.664	0.559
Vaccine safety data is often falsified	3.86	1.86		0.876	0.233
Vaccinating children is harmful and this fact is hidden	3.03	1.80		0.796	0.367
People are being misled about the effectiveness of vaccines	3.61	1.81		0.877	0.231
Pharmaceutical companies hide the dangers of vaccines	3.67	1.78		0.881	0.224
The information that comes to us about vaccines is highly manipulated	4.01	1.81		0.876	0.232

Note: All items range from 'Disagree' (1) to 'Agree' (7).

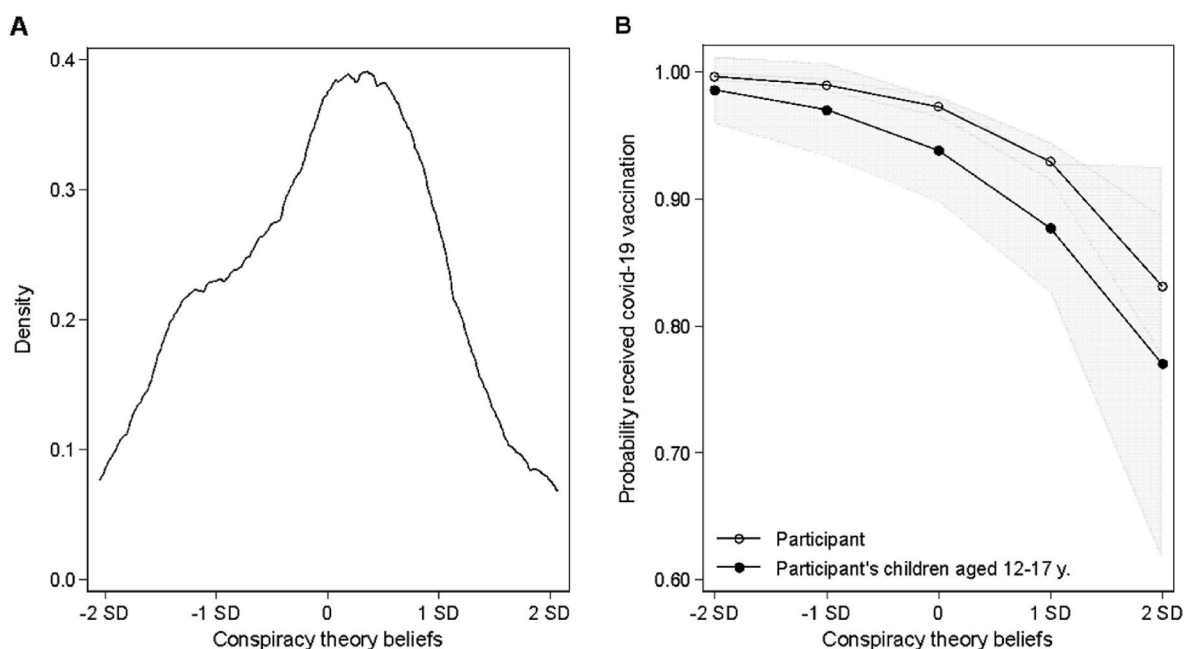


Fig. 1. Panel A: Distribution of the conspiracy theory beliefs outcome. Density plot. Panel B: Participants who believe in conspiracy theories more strongly are less likely to be vaccinated against covid-19 and less likely to get their 12–17 year-old children vaccinated. Predicted probabilities obtained from logistic regression models regressing vaccination status (at least first dose) on conspiracy theory beliefs. Error bands denote 95% confidence intervals. 95% confidence intervals for children’s vaccination status are cluster-robust to account for participants with more than one child.

3.1.3. Covariates

We examine *sex*, *age* (broken down into categories that approximate decades), *education* (distinguishing between lower primary (or less), lower secondary, upper secondary, and tertiary education), and whether participants work in a *health care occupation* (as nurse, doctor, or pharmacist). We further control for a potentially confounding variable in our final model. Participants’ *psychological distress* is measured with one item ‘I have experienced increased anxiety or depression as a result of the pandemic.’ Response options range from ‘not affected’ (1) to ‘very affected’ (7). Believing in COVID-19 conspiracy theories goes along with higher levels of anxiety and depression (De Coninck et al., 2021;

Fountoulakis et al., 2021; Sallam et al., 2020) and mental health trajectories during the pandemic have been heterogeneous yet socially patterned (Ellwardt and Präg, 2021). Comparing individuals with a similar level of psychological distress allows us to rule out psychological distress as a common cause of sociological factors and beliefs in conspiracy theories. Descriptive statistics of all variables can be found in Table 2.

3.1.4. Analytical strategy

In the first step, we conduct bivariate analyses to demonstrate the (lack of) association between conspiracy theory beliefs and three sets of

Table 2
Descriptive statistics.

	Mean	SD	Min.	Max.
Conspiracy theory beliefs	-0.03	0.98	-2.05	2.07
Female (ref. male)	0.49		0.00	1.00
Age:				
18–29 y.	0.15		0.00	1.00
30–39 y.	0.16		0.00	1.00
40–49 y.	0.22		0.00	1.00
50–59 y.	0.18		0.00	1.00
60–69 y.	0.16		0.00	1.00
70–93 y.	0.13		0.00	1.00
Education:				
Primary or less	0.07		0.00	1.00
Lower secondary	0.25		0.00	1.00
Upper secondary	0.32		0.00	1.00
Tertiary	0.36		0.00	1.00
Nurse, doctor, or pharmacist	0.06		0.00	1.00
Trust in government health authorities	5.62	1.40	1.00	7.00
Trust in pharmaceutical companies	3.33	1.63	1.00	7.00
Trust in Science I	5.82	1.26	1.00	7.00
Trust in Science II	4.34	1.84	1.00	7.00
Political ideology:				
1 Extreme left	0.05		0.00	1.00
2	0.14		0.00	1.00
3	0.25		0.00	1.00
4	0.24		0.00	1.00
5	0.17		0.00	1.00
6	0.12		0.00	1.00
7 Extreme right	0.02		0.00	1.00
Religious affiliation:				
Catholic practicing	0.22		0.00	1.00
Catholic non-practicing	0.41		0.00	1.00
Other religion	0.01		0.00	1.00
Indifferent	0.20		0.00	1.00
Atheist	0.16		0.00	1.00
Psychological distress	4.64	1.75	1.00	7.00
Observations	1615			

predictors: conventional sociodemographic variables, variables denoting instrumental rationality, and variables denoting value rationality. In a second step, we test if these findings hold when we adjust the associations for one another in multiple ordinary least squares regression models. When interpreting our statistical findings, we do not only focus on statistical precision (indicated by 95% confidence intervals, standard errors, and *p*-values), but also effect sizes. Given that our outcome variable conspiracy theory beliefs is standardized to have a standard deviation of one, mean differences and regression coefficients can readily be interpreted as effect sizes. To facilitate comparisons between variables and models we also put an emphasis on the coefficient of determination R-squared, the proportion of the variation in the outcome variable that is predictable from the independent variable(s). When the independent variable is categorical, R-squared is identical to the eta-squared as obtained from an analysis of variance.

In a final step, we conduct a robustness check for the multivariate analyses by using full-information likelihood (FIML) estimation to address any missing values in the data. FIML is a ‘flagship technique’ in modern missing data analysis (Lang and Little, 2018), as it is robust to ignorable item nonresponse and leverages all information when fitting a statistical model.

3.1.5. Replicability

The data analyzed in this study are publicly available (FECYT, 2022) and a replication package containing all Stata code is available on-line (Nefes et al., 2023).

4. Results

Table 2 describes all variables used in the analyses and gives an impression of the demographic composition of the sample. Participants

are 49% females and range in age from 18 to 93 years. Seven per cent are lower-educated, 25% have lower and 32% have upper secondary education, 36% are tertiary educated. Six per cent are in health care occupations.

Fig. 2 shows the bivariate associations of conspiracy theory beliefs with the sociodemographic variables age (Panel A), sex (Panel B), education (Panel C), and health care occupation (Panel D). Across the board, there are hardly any associations; the amount of variation that the sociodemographic variables account for in conspiracy theory beliefs ranges from 0.00 (sex, education, health care occupation) to 0.01 (age). Group deviations from the overall average of conspiracy theory beliefs are at most $-.23$ standard deviations (that is the extent to which those in health care occupations are less likely to endorse conspiracy theory beliefs, Panel D). The association between age and conspiracy theory beliefs is non-linear, with those in the youngest and oldest age brackets being less likely to endorse conspiracy theory beliefs (Panel A), yet it is substantively small with an R-squared of 0.01. Panel B reveals that men and women believe in conspiracy theories to a similar extent. Education and conspiracy theory beliefs are related in a non-linear fashion, with those at the bottom and the top of the educational distribution endorsing conspiracy theories less than those in the middle; however, this association is very small (Panel C). Panel D visualizes the difference in conspiracy theory beliefs that is associated with working in health care occupations. Compared to the overall sample, those working as nurses, doctors, and pharmacists have a $.23$ standard deviations lower score on the conspiracy theory belief measurement, which is also a small effect.

Fig. 3 shows the associations between indicators of instrumental rationality with conspiracy theory beliefs. Participants who place higher trust in government health authorities (Panel A) and pharmaceutical companies (Panel B) exhibit considerably lower conspiracy theory beliefs, as indicated by the R-squareds of 0.09 and 0.24, respectively. Greater trust in science is not strongly associated with lower conspiracy theory beliefs (Panels C and D), with R-squareds of 0.04 and 0.02. This gives us mixed support of Hypothesis 1, which had posited that conspiracy theory beliefs are more pronounced when trust in relevant institutions is lower.

A comparison of the conspiracy theory belief averages by response category with the linear fit shows that the linear fit is mostly accurate.

Value rationality considerations vary in their association with conspiracy theory beliefs. When looking at political ideology and conspiracy theory beliefs we see a relatively weak linear association as long as we disregard the extremes (Panel A of Fig. 4). Participants who place themselves on the left of the political spectrum are less likely to endorse conspiracy theory beliefs than those on the right. Important exceptions to this relationship are respondents who place themselves on the extremes. Those on the extreme left endorse conspiracy theory beliefs to the same extent as the entire sample on average, those on the extreme right in turn endorse conspiracy theory beliefs to a very high extent (.67 standard deviations, significantly higher than those in the adjacent right category with 0.16). In general, however, the association between political ideology and conspiracy theory beliefs is weak with an R-squared of 0.03.

A pairwise comparison using Tukey’s honestly significant difference correction (Maxwell et al., 2018) to account for the multiple comparisons yielded statistically significant differences between the extreme left (1) and the extreme right (7). The group right next to the extreme left (2) differs significantly from groups 4–7. The left-of-center group (3) differs significantly from groups 5–7. The center group (4) differs significantly only from the extreme right (7). The right-of-center group (5) differs significantly from groups 2 and 3 as well as from the extreme right (7). The group right next to the extreme right (6) differs significantly from groups 2 and 3 as well as from the extreme right (7). The extreme right (7) differs from all other groups.

Religious affiliation is clearly unrelated to conspiracy theory beliefs (R-squared = 0.00, Panel B). The only outlier seems to be those reporting that they are of an ‘other religion,’ who are 0.44 standard deviations

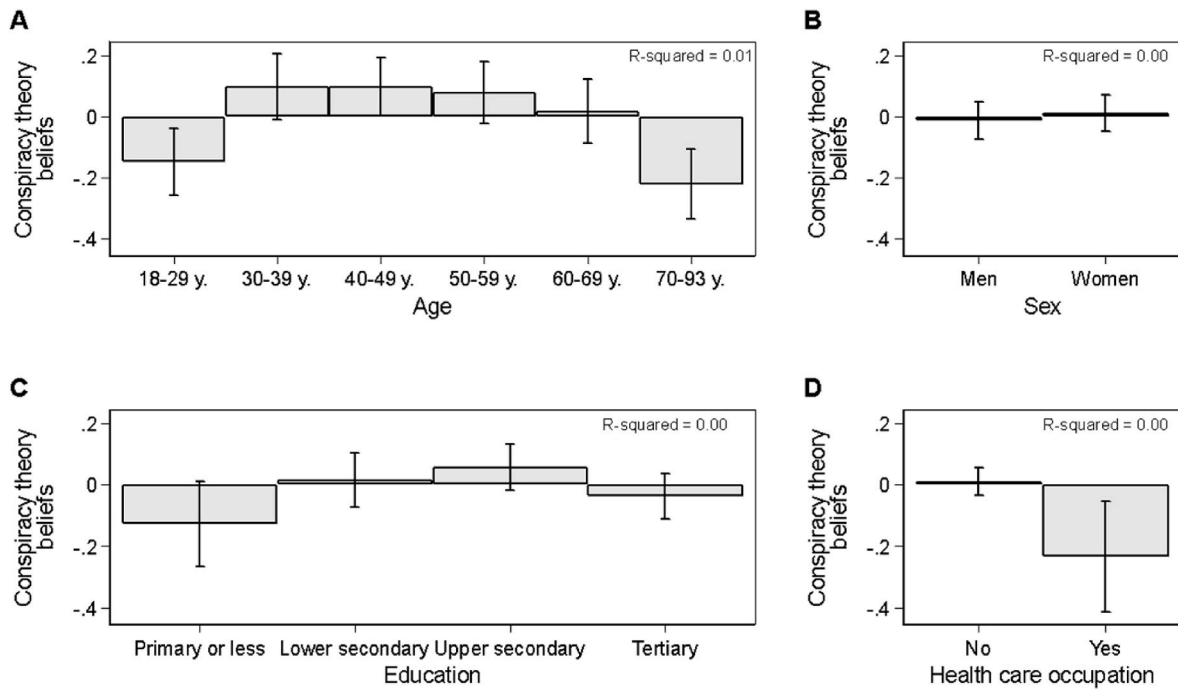


Fig. 2. Sociodemographic variables age (Panel A), sex (Panel B), education (Panel C), and health care occupation (Panel D) are only weakly correlated to conspiracy theory beliefs. Bars denote the group deviations from the average level of conspiracy theories in Spain (i.e. 0), error bars denote 95% confidence intervals. R-squared stem from simple ordinary least squares regression models that regress conspiracy theory beliefs onto the dummy variables shown in the panels.

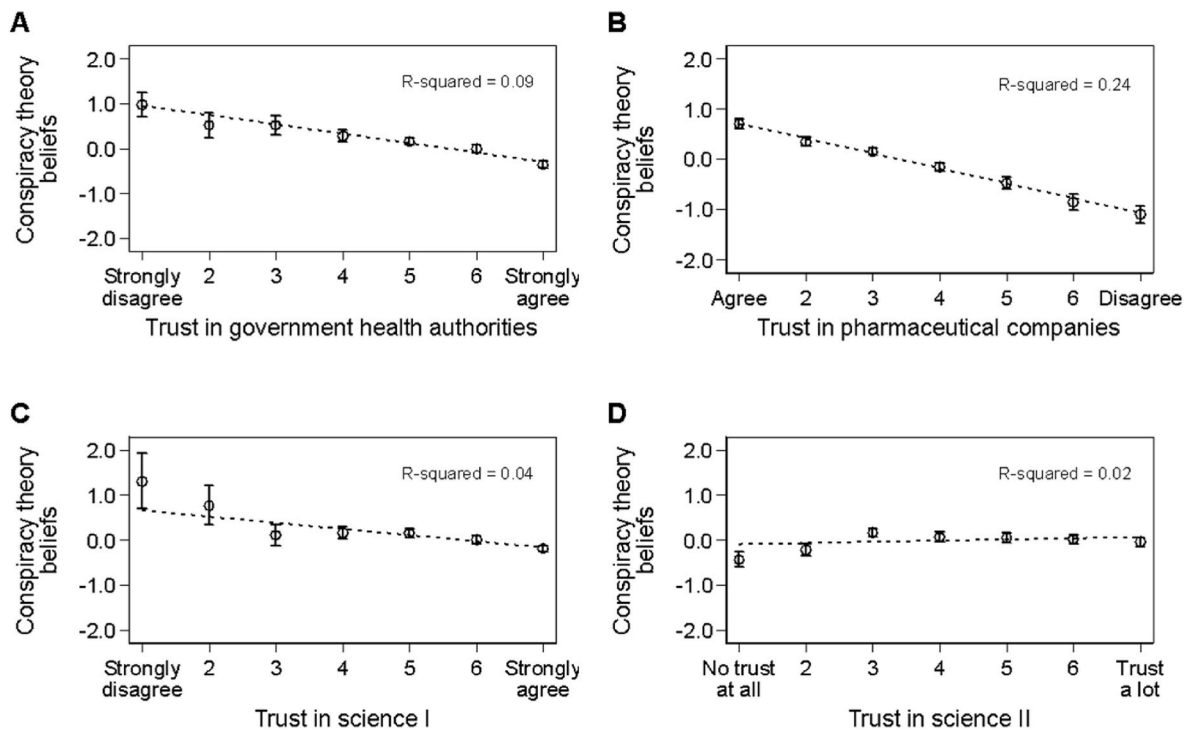


Fig. 3. Greater instrumental rationality considerations mostly go along with lower conspiracy theory beliefs. Average (mean) conspiracy theory beliefs by each response option of instrumental rationality indicator with error bars denoting 95% confidence intervals and corresponding R-squared. Dotted line indicates linear fit across response options.

above the sample average when it comes to conspiracy theory beliefs, yet the group is too small ($n = 21$) for the difference to reach statistical significance. This gives us little support of Hypothesis 2, which had posited that conspiracy theory beliefs are more pronounced when they are congruent with religious and political beliefs.

Table 3 confirms that the main findings just discussed hold when mutually adjusting variables. Model (1) that includes all demographic controls simultaneously shows that it is only the non-linear age differences that are associated with conspiracy theory beliefs when adjusting for sex, education, and health care occupation. Model (2) additionally

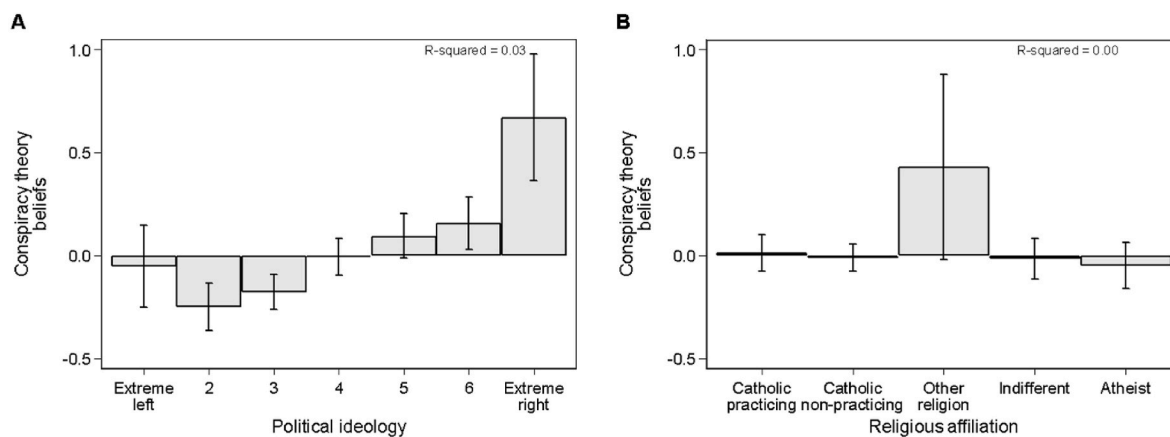


Fig. 4. Value rationality considerations such as political ideology (Panel A) and religious affiliation (Panel B) don't necessarily go along with lower conspiracy theory beliefs. Bars denote the group deviations from the average level of conspiracy theories in Spain (i.e. 0), error bars denote 95% confidence intervals. R-squared stem from simple ordinary least squares regression models that regress conspiracy theory beliefs onto the dummy variables shown in the panels.

Table 3
Conspiracy theory beliefs regressed on different sets of predictors, OLS regression.

	(1) Sociodemographics only	(2) Instrumental rationality	(3) Value rationality	(4) All	(5) Control
Female (ref. male)	0.02 (0.05)	-0.00 (0.04)	0.01 (0.05)	-0.00 (0.04)	-0.01 (0.04)
Age (ref. 40–49 y)					
18–29 y.	-0.25** (0.08)	-0.23*** (0.07)	-0.19* (0.08)	-0.16* (0.07)	-0.15* (0.07)
30–39 y.	0.05 (0.08)	0.07 (0.07)	0.05 (0.08)	0.07 (0.07)	0.07 (0.06)
50–59 y.	0.04 (0.08)	0.08 (0.06)	0.04 (0.08)	0.07 (0.06)	0.08 (0.06)
60–69 y.	-0.07 (0.08)	-0.00 (0.07)	-0.07 (0.08)	-0.00 (0.07)	0.00 (0.07)
70–93 y.	-0.30** (0.09)	-0.03 (0.08)	-0.28** (0.09)	-0.04 (0.08)	-0.03 (0.08)
Education (ref. upper secondary)					
Primary or less	0.04 (0.10)	0.02 (0.09)	0.04 (0.10)	0.02 (0.09)	0.02 (0.09)
Lower secondary	0.05 (0.07)	0.05 (0.06)	0.05 (0.07)	0.06 (0.06)	0.05 (0.06)
Tertiary	-0.04 (0.06)	-0.07 (0.05)	-0.05 (0.06)	-0.07 (0.05)	-0.07 (0.05)
Nurse, doctor, or pharmacist (ref. no)	-0.20 (0.11)	0.02 (0.09)	-0.17 (0.11)	0.03 (0.09)	0.02 (0.09)
Trust in government health authorities		-0.14*** (0.01)		-0.14*** (0.01)	-0.14*** (0.01)
Trust in pharmaceutical companies		-0.29*** (0.01)		-0.29*** (0.01)	-0.29*** (0.01)
Trust in Science I		-0.10*** (0.02)		-0.10*** (0.02)	-0.10*** (0.02)
Trust in Science II		0.06*** (0.01)		0.06*** (0.01)	0.06*** (0.01)
Political ideology (ref. midpoint 4)					
1 Extreme left			-0.08 (0.12)	-0.12 (0.10)	-0.11 (0.10)
2			-0.28*** (0.08)	-0.21** (0.07)	-0.21** (0.07)
3			-0.20** (0.07)	-0.17** (0.06)	-0.17** (0.06)
5			0.07 (0.08)	0.13* (0.06)	0.13* (0.06)
6			0.11 (0.08)	0.13 (0.07)	0.12 (0.07)
7 Extreme right			0.58** (0.18)	0.35* (0.15)	0.35* (0.15)
Religious affiliation (ref. Catholic non-practicing)					
Catholic practicing			0.08 (0.06)	0.02 (0.05)	0.01 (0.05)
Other religion			0.35 (0.28)	0.15 (0.23)	0.16 (0.23)
Indifferent			0.01 (0.07)	-0.01 (0.06)	-0.01 (0.06)
Atheist			0.01 (0.08)	-0.04 (0.06)	-0.04 (0.06)
Psychological distress					0.02 (0.01)
Constant	0.04 (0.06)	2.10*** (0.14)	0.07 (0.08)	2.04*** (0.15)	1.96*** (0.16)
Observations	1615	1615	1615	1615	1615
R-squared	0.02	0.33	0.05	0.35	0.35
Adjusted R-squared	0.01	0.32	0.04	0.34	0.34
F-value	3.2	56	4.3	36	35
df between	10	14	20	24	25
df within	1604	1600	1594	1590	1589

Standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

controls for instrumental rationality considerations and shows that trust in institutions and science are associated with lower conspiracy theory belief scores. These associations are sizable, as standard deviations for these items are in the range of 1.3–1.8 (Table 2), thus a one-point increase on the response scale going along with a -0.28 SD decrease in conspiracy theory beliefs can be considered a relatively strong effect. The R-squared of 0.33 for the full model is considerably larger than the

R-squared for the sociodemographics-only Model (1) of 0.02. One exception is the second 'trust in science' item, which, after mutual adjustment, shows a small positive association with conspiracy theory beliefs, while the zero-order association shown in Fig. 3 was practically zero.

Model (3) estimates coefficients for the value rationality considerations as well as the sociodemographic variables. Results are largely in

line with those shown in Fig. 4; associations are weak, but those identifying as extreme-right show considerably greater endorsements of conspiracy theory beliefs. The R-squared for the full model is 0.05, hardly an improvement over the R-squared of the sociodemographics-only Model (1) and considerably smaller instrumental rationality Model (2). Model (4) mutually adjusts for both instrumental and value rationality, with coefficients being largely stable; Model (5) adds an additional control for psychological distress during the pandemic, yet it does not affect the main findings either.

Table A1 in the Supplementary Materials documents the amount of missing data across all variables in the analysis. While the extent of missing data seen for each variable separately is small and in line with what is usually seen in survey data collection, it adds up to a loss of almost 500 cases in the fully adjusted model based on listwise deletion of incomplete observations. To address this issue, we present estimates based on full-information maximum likelihood in Table A2 in the Supplementary Materials. Results are substantively the same.

5. Limitations

There are limitations to this study. First, it delves into cross-sectional data that offer a snapshot view of conspiracy theory beliefs in Spain. Considering the potential shifts in public opinion and conspiracy theory beliefs over time, our data cannot support any definitive causal conclusions. Subsequent studies could conduct longitudinal analyses to ascertain the reliability of these conclusions across varying periods and contexts. Second, the study examines participants' responses regarding their religious affiliation and ideological orientation as a means to explore their religious and ideological values. However, these measurements are not direct. While a variable gauging the intensity of religious beliefs could have enhanced our analysis, declaring a religious affiliation entails a commitment to a specific religious ethic that could be construed as aligning with distinct value systems. Similarly, recent research on voting behavior underscores the value-based aspect of political affiliation (Becker, 2023). In short, although somewhat imprecise, our study still furnishes an analysis that draws from individuals' overarching religious and ideological tendencies that may influence their values. Third, the study is based on a secondary analysis of a survey carried out by the Spanish Foundation for Science and Technology (FECYT). Had we designed our own questionnaire, we would have generated more precise variables and included additional variables to test hypotheses based on the Weberian theory of rationality, consequently mitigating the second limitation as well.

6. Discussion and conclusion

The present study tackles the challenge of understanding social factors that contribute to belief in conspiracy theories, particularly with regard to COVID-19. Its main findings are the following:

- 1) Conspiracy theory beliefs are associated with considerably worse vaccination behaviors, also among the under-age children of those who hold the conspiracy theory beliefs
- 2) Conspiracy theory beliefs are not or only very weakly associated with standard demographics such as age and sex, same goes for education and health care occupations
- 3) Conspiracy theory beliefs are related to instrumental rationality considerations
- 4) Conspiracy theory beliefs are weakly related to value rationality indicators such as ideological and religious affiliations

Main Finding 1) shows that conspiracy theory beliefs are an important target for public health policy, yet Main Finding 2) reveals the size of the challenge. The lack of an association with age and gender shows that it is impossible to target groups based on routinely collected public health data, further does the lack of a clear association with education

raise grave doubts that conspiracy theory beliefs can be changed with educational interventions. The relatively small difference in conspiracy theory beliefs between those in health care occupations and the general population also emphasizes this, as even medical training seems to only have a small effect on conspiracy theory beliefs.

In order to enhance the overall health of the population and diminish the occurrence of outbreaks, there exists the potential for communication strategies employed by the public sector to address prevalent misinformation and conspiracy theories (Milosevic Dordevic et al., 2021). Exploring the social and political values and instrumental rationales associated with higher levels of belief in conspiracy theories could help in developing these strategies. Our study employs Weberian sociological theory, which addresses this issue by facilitating the differentiation of rationales associated with conspiracy theories. The research distinguishes between social factors that are grounded in instrumental and value rationality and reports their effect sizes. Specifically, it identifies the following factors: trust in science, government health authorities, and pharmaceutical companies (Main Finding 3). It adds that ideological orientation, particularly among those on the extreme right, has a lesser impact on conspiracy theory beliefs (as demonstrated by Main Finding 4). Consequently, the policies aimed at reducing the impact of conspiracy theories about COVID-19 in Spain should focus on building trust in institutions and science. This could include implementing programs to improve scientific and media literacy. These programs could help members of the public understand the scientific process better and identify misinformation more easily. Additionally, making official communication to the public more transparent is important. Furthermore, individuals who self-identify with an extreme right-wing ideological stance, along with areas with higher levels of support for extreme right-wing political parties, could be suitable candidates for these strategies. This includes health care initiatives aimed at bolstering vaccination rates.

The Weberian theoretical approach has the potential to be employed in different contexts, where the association of instrumental and value rational thinking with belief in conspiracy theories would vary (e.g., De Coninck et al., 2021). Indeed, the academic literature has revealed a diverse range of factors that are contingent on the context in which they are studied: political ideology (Galais and Guinjoan, 2022; Koon et al., 2021; Romer and Jamieson, 2022; Stoler et al., 2022; Uscinski et al., 2020), religiosity (Kim and Kim, 2021), institutional trust (Bruder and Kunert, 2022) and education level (Ferreira et al., 2022). Thus, future studies could explore and compare factors related to instrumental and value rationality in different societies. In so doing, they could serve as a guide for policy makers in formulating precise strategies to counter medical conspiracy theories.

Declaration of competing interest

The authors have no conflict of interest to declare. One of the authors, P. P., wishes to disclose that his spouse is a shareholder and employee of a UK biotech firm that develops vaccines.

Data availability

The data analyzed are publicly available (FECYT, 2022) and a replication package containing all Stata code is available on-line (https://osf.io/kyq79/?view_only=e08be8091b3647a495e0e3a70e9ab74c).

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Appendix A. Supplementary data

Supplementary Materials contain additional information about missing data and a robustness check using full-information maximum likelihood.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2023.116263>.

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