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Moral predictors of antivaccination attitude in the Italian COVID-19 post pandemic era

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Abstract

Background. Vaccine hesitancy encompasses a complex attitude intertwined with social, cognitive, and affective processes not clearly understood. We aimed to provide new insights into the field by focusing on the role of ethical appraisal in vaccine hesitancy.

Methods. We utilized the Moral Foundations Questionnaire (MFQ) and a set of moral dilemmas to investigate potential links between explicit measures of moral appraisal such as moral reasoning and moral decision making and vaccine hesitancy (VH), as measured by the adult Vaccine Hesitancy Scale. Furthermore, we investigated whether Misinformation susceptibility about COVID-19 could affect the aforementioned link.

Results. The MFQ results document a higher endorsement of authoritarianism in individuals with high VH than those with low VH, in contrast to the previous literature. The Moral dilemma results document a negative relationship between the tendency to prefer incidental (but not instrumental or filler) moral dilemma resolutions and VH scores, regardless of moral judgement, emotional valence and arousal associated to the dilemmas. Additionally, a moderation effect of misinformation susceptibility about COVID-19 showed that only in highly (+1SD) and medium (but not low, i.e., -1SD) informed people VH scores are negatively predicted by the tendency to apply incidental dilemma resolutions.

Discussion. These results extend current research in the field by showing that moral decision-making and misinformation susceptibility about COVID-19 are predictors of a larger hesitancy to get vaccinated in the COVID-19 post-pandemic era.

Keywords: Vaccine Hesitancy, Moral Dilemmas, COVID-19, Misinformation, Moral Foundations, Moral decision-making

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Introduction

The emergence of the severe acute respiratory syndrome caused by coronavirus 2 (Sars-CoV-2) marked a worldwide public health emergency, with an estimated excess mortality of at least 14 million deaths during 2020-2021 (*Global Excess Deaths Associated with COVID-19, January 2020 - December 2021*, s.d.; Wong et al., 2023).

Crucially, multiple vaccines were developed for COVID-19 prevention, and efficient governmental measures were required to tackle this global challenge, including the development of efficient vaccination strategies (Neumann-Böhme et al., 2020).

Despite the beneficial effects of COVID-19 vaccines on infection rates, hospital admissions, and death rates, with only minor to moderate safety concerns (Christie et al., 2021; Gilbert et al., 2022; Lamprinou et al., 2023; Sadoff et al., 2021), large portions of the world population show vaccine hesitancy (VH) or resistance (VH) towards vaccination (Guidry et al., 2021; Kricorian et al., 2022; Murphy et al., 2021; Neumann-Böhme et al., 2020), posing a significant risk to vaccination efficacy at the population level. VH is defined as a complex spectrum of attitudes towards vaccines that ranges from "doubtful acceptance" to "open refusal" of vaccination (Dubé et al., 2013; MacDonald, 2015). Research indicates that VH is the result of a complex mixture of social, cognitive, and emotional factors. Misinformation is a primary factor driving VH in many individuals (Garett & Young, 2021; Kricorian et al., 2022; Lee et al., 2022; Loomba et al., 2021; Neely et al., 2022; Roozenbeek et al., 2020). Since their introduction in the early 1800s,vaccines have been the subject of controversies that have influenced acceptance (Wolfe & Sharp, 2002). One such controversy is the unsubstantiated association between the hepatitis B vaccine and multiple sclerosis, which, in France in 1998, led to the cessation of universal vaccination, despite a lack of evidence supporting this claim (Monteyne & André, 2000). A more recent example is the debunked claim linking vaccines to autism, which continues to cause undue concerns among parents (Poland, 2011). With the advent of the internet and social networks (Kata, 2010; Tustin et al., 2018), the spread of misinformation about immunization and vaccination is facilitated by social media, which lack monitoring for the correctness of information. During the COVID-19 pandemic, social media gained an even more significant role, as pandemic-related restrictions made their use essential as a tool for maintaining social connections (Limaye et al., 2020). This enabled the rapid spread of incorrect (and often negative) information about COVID-19 vaccines contributing to increased hesitancy and mistrust (Lalot et al. 2022; Moscadelli et al., 2020). In addition to misinformation, other predictors of Vaccine Hesitancy (VH) include emotional states and bodily awareness. For instance, a recent research (Vicario et al., 2024) on individual predictors of vaccine hesitancy in the post-pandemic period, found that lower interoceptive awareness and reduced cognitive empathy are associated with greater vaccine hesitancy in the post-pandemic era. Additionally, conservatism, (Bilewicz & Soral, 2022) reduced fear extinction learning (Vicario et al., 2023), and anxiety (Bendau et al., 2021; Sekizawa et al., 2022) are linked to VH, although findings regarding anxiety are heterogeneous (Kaewkrajang et al., 2023; McNeil & Purdon, 2022).

The current study aims to broaden our understanding of the predictors of vaccine hesitancy in the post-COVID-19 era by examining the impact of moral cognition. One of the first

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definitions of morality comes from Turiel (Turiel, 1983) as the "prescriptive judgements of justice, rights, and welfare pertaining to how people ought to relate to each other". More recent definitions of morality highlight the role of emotional, cognitive, and motivational factors (e.g., Vicario and Rafal., 2017; Vicario and Lucifora, 2021; Lucifora et al., 2021; Vicario et al., 2018, 2022) and encompass diverse perspectives: a descriptive one, portraying it as "the most important code of conduct put forward and accepted by any group, or even by an individual", and a normative one, representing it as "a code of conduct that, given specified conditions, would be put forward by all rational persons" (Gert & Gert, 2002; Luco, 2014). These perspectives highlight the complexity and variable nature of morality. Theoretical work has emphasized the existence of different moral intuitions (i.e., moral judgements, usually about specific problems, not derived from inferential reasoning or existing beliefs but independently emerging) (Pagliaro et al., 2021; McMahan, 2013). For example, the Moral Foundation Theory postulates the existence of innate psychological systems (named as "moral foundations") that are universal and serve as fundamental components of morality (Graham et al., 2013; Haidt & Joseph, 2004).

In the context of moral decision-making, a moral dilemma is a scenario in which an individual must decide between two or more courses of action, each of which is burdened by conflicting moral considerations (Mason, 1996). Classic dilemmas, such as deciding whether to sacrifice one life to save several others, illustrate the inherent challenges in balancing ethical considerations. However the individual decides, this choice invariably leads to an ethically controversial action or neglect of a moral requirement (Mason, 1996; Sinnott-Armstrong, 1983).

Moral dilemma tasks are employed for the investigation of morality (i.e., any process encompassing assessments, judgements, and decisions, formulated within the realm of morality) (Garrigan et al., 2018; Turiel, 1983), allowing researchers to investigate moral judgement and moral decision-making separately, as well as their affective correlates (Lotto et al., 2014). Moral decision-making involves weighing competing moral principles (e.g., "utilitarianism", "duty of rescue", and "duty of non-maleficence"), whereas moral judgement primarily focuses on assessing the moral correctness of an action based on moral intuitions (Kahane, 2015; Kahane et al., 2015; Lowry & Peterson, 2012). Moral considerations related to health protection and norm adherence can significantly influence vaccination attitudes: debates surrounding vaccination campaigns often revolve around the moral imperative to safeguard vulnerable populations by immunizing entire communities, portraying this action as morally upright and ethically justifiable (Francis & McNabb, 2022; Rosenfeld & Tomiyama, 2022; Zhou et al., 2022). This narrative mirrors the moral discourse surrounding government-implemented COVID-19 containment measures (Travaglino and Moon, 2021; Prosser et al., 2020). As a public health-relevant scenario, vaccine decision-making involves choosing between the risk of the many people dying from the virus and the risk of a few dying from the infrequent adverse effects of the vaccines (Ale et al., 2023). Previous studies have shown a positive correlation between preference for sacrificial choices in moral dilemmas and support for mandatory vaccination, which supports the parallel between moral dilemmas and vaccine decision scenarios (Clarkson & Jasper, 2022).The influence of morality on vaccine attitudes and decisions is also evident at the individual level, where moral principles such as personal liberty,

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risk-benefit analysis, societal responsibilities, and collective welfare considerations shape vaccination attitudes.

Some individuals may prioritize personal autonomy over collective health, leading to resistance against vaccination due to perceived violations of their freedom (Amin et al., 2017; Rossen et al., 2019). Empirical studies indicate that Purity (sanctity/degradation) and Liberty/Oppression moral foundations (MF), as assessed by the Moral Foundations Questionnaire (MFQ) (Graham et al., 2011), are significantly associated with VH, while care/harm, fairness/cheating, and loyalty/betrayal MF had mixed or no significant associations in a couple of studies (Amin et al., 2017; Betsch & Böhm, 2018; Nan et al., 2022; Pizza et al., 2023; Schmidtke et al., 2022). In contrast, a preference for loyalty/betrayal moral values has been linked to lower vaccine hesitancy in the study by Nan et al. (Nan et al., 2022). Additionally, a focus on care moral foundations was associated with reduced hesitancy in studies by Nan et al. (Nan et al., 2022), Schmidtke et al. (Schmidtke et al., 2022), and Betsch & Bohm (Betsch & Böhm, 2018), though not consistently across all research. Furthermore, individuals who value authority moral foundations tend to exhibit lower vaccine hesitancy, as observed in studies by Pizza and co-workers (Pizza et al., 2023), Schmidtke (Schmidtke et al., 2022), and Amin et al. (Amin et al., 2017), as well as in one of two surveys in the Betsch & Bohm study (Betsch & Böhm, 2018). Despite the surge in research driven by the COVID-19 pandemic in recent years, studies examining how different aspects of moral appraisal predict VH outside of a pandemic emergency are lacking. Given these premises, a first objective is testing the relationship between moral decision-making and moral judgement as measured by moral dilemmas, and VH, examining the role of misinformation susceptibility as potential moderator of this relationship.

A second objective is testing the association between moral foundations as postulated by Graham et al. (Graham et al., 2011) and VH. Furthermore, we explored the correlation between VH and variables previously linked to VH, such as social and economic conservatism, political orientation (Bilewicz & Soral, 2022), fear (Vicario et al., 2023), interoceptive awareness (Vicario et al., 2024).

Research questions and hypotheses

This research aimed to investigate the relationship between VH, moral decision-making, moral judgement, and misinformation susceptibility about COVID-19. The novelty of this approach lies in the hypothesis that, for certain populations (specifically, individuals less susceptible to COVID-19 misinformation), vaccine decision scenarios present a moral dilemma. This highlights the significant impact of contextual beliefs on risky decision-making and underscores the necessity to implement different communication strategies for various populations.

We specifically aimed to answer the following research questions: 1) To what extent do participants with high VH differ from participants with low VH in moral dilemma resolution choices? 2) To what extent do moral dilemma resolution choices and misinformation susceptibility about COVID-19 interact with respect to the prediction of VH? 3) To what extent do moral judgement, emotional valence and arousal about a dilemma resolution affect the

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interaction between misinformation susceptibility and the relationship between resolution choices and VH? 4) To what extent do participants with high VH differ from participants with low VH in moral foundations?

Since vaccine hesitant people tend to be more rigid to moral violations (i.e., they rigidly avoid moral violation such as causing harm to someone), and tend more to privilege non-acceptance of moral dilemmas sacrifices than non-hesitant ones (Ale et al., 2023; Clarkson & Jasper, 2022), we hypothesize that (i) individuals with high VH will show lower incidental and instrumental (but not filler) dilemma resolution acceptance (which requires the violation of moral rules to save people) compared to low VH ones. Because misinformation susceptibility about vaccines is associated with vaccine hesitancy and refusal (Garett & Young, 2021; Kricorian et al., 2022; Loomba et al., 2021; Neely et al., 2022; Roozenbeek et al., 2020), we hypothesize that (ii) the incidental and instrumental (but not filler) dilemma resolution acceptance score and Misinformation susceptibility about COVID-19 will each independently predict VH scores. Given that moral dilemmas involve a conflict between various moral arguments for and against a decision, individuals highly susceptible to misinformation about COVID-19 would tend to be skewed towards reasons opposing vaccination (Kricorian et al., 2022). For these individuals, the decision regarding vaccination could not be characterized by equal moral competing implications as in low susceptibility ones. In particular, (iii) in participants with low (but not high) Misinformation susceptibility scores, the incidental and instrumental (but not filler) dilemma resolution acceptance will negatively predict VH (the higher the propension toward sacrifice for a higher good, the lower the VH). Finally, as observed in previous research (Amin et al., 2017; Betsch & Böhm, 2018; Nan et al., 2022; Pizza et al., 2023; Schmidtke et al., 2022) (iiii) Individuals with high VH will exhibit higher sanctity/degradation and lower authority/subversion moral foundation questionnaire scores (the higher the VH, the higher the moral value assigned to sanctity, and the lower the moral valued assigned to authority in participants' value system).

Materials and Methods

2.1 Participants

The sample consisted of 100 young and healthy volunteers of Italian nationality, aged between 18 and 40 years, with a mean age (M_{Age}) of 24.50 years and a standard deviation (SD_{age}) of ±6.86; (females: N=43, M_{Age}=26.14 ± 7.26; males: N=53, M_{Age}=23.37 ± 6.45; unspecified gender: N=4, M_{Age}= 21.75 ± 4.99). 40 of them were workers, 59 students, and one both worker and student.

All subjects provided written consent after being informed about the study procedures and their right to anonymity. The procedures were approved by the Local Ethics Committee of the Department of Cognitive, Psychological, Pedagogical and Cultural Studies (Approval n. COSPECS_07_2022) of the University of Messina and complied with the ethical standards of the 1964 Declaration of Helsinki.

2.2 Measures

The research protocol required the volunteers to fill in an online anamnestic survey (gender, age, occupation), a series of questionnaires, and then to solve a series of moral dilemmas (Lotto et al., 2014).

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The following questionnaires and scales were used:

The *Adult Vaccine Hesitancy Scale* (aVHS), a scale for assessing attitudes toward vaccines (Shapiro et al., 2018). It consists of 10 assertions (e.g., "*I vaccini sono importanti per la mia salute*" (Vaccines are important for my health) about vaccines, and the degree of agreement with each item is rated on a 5-point Likert scale (1-to-5). The internal consistency (IC) of the Italian version of the aVHS (Cronbach's α =0.94), the test-retest validity (for two months, intra-class correlation .87), and the content validity (measured by the S-CVI, .97) are excellent (Ledda et al., 2022). The cutoff score to establish whether participants are classified as highly hesitant to vaccination is > 25, according to Akel et al. (2021).

The Six-item *Misinformation* Susceptibility *Scale about COVID-19*, a 7-point Likert scale (1-to-7) developed by Roozenbeck et al. (Roozenbeek et al., 2020) for measuring misinformation susceptibility about COVID-19. It consists of a total of nine statements about the virus, including six common instances of health-related and political misinformation. Additionally, two statements are based on factual information, while one statement is not false but rather ambiguous (Roozenbeek et al., 2020). Reliability analyses from the original article showed a Cronbach's α =0.83 for the misinformation items, and Cronbach's α =0.35 for factual and ambiguous items (Roozenbeek et al., 2020).

The *Moral Foundations Questionnaire* (MFQ) (Graham et al., 2011), a 6-point Likert scale (0-to-5) designed to assess the degree to which people prioritize five foundational domains in moral decision-making: 1) care/harm, 2) fairness/cheating, 3) loyalty/betrayal, 4) authority/subversion, and 5) sanctity/degradation. These five domains are described in the Moral Foundations Theory (MFT), which is grounded on evolutionary theory and supported by ethnographic evidence (Graham et al., 2013).We employed the 2008 version of the MFQ-30 in its Italian version (Bobbio et al., 2011). The MFQ has adequate reliability (Davies et al. 2014), with Cronbach's alpha coefficients for the total scores ranging from 0.65 to 0.84 (Graham et al., 2011).

A subset of 15 *Moral Dilemmas* from the set developed by Lotto et al. (Lotto et al., 2014) in its official Italian version, which was recently used in another study of our group (Lucifora et al., 2021), was selected. Six of the dilemmas were incidental, six instrumental, and three were filler dilemmas. Moral dilemmas consist of a series of scenarios in which participants are required to choose between two alternative actions, and where both actions have problematic ethical implications. Usually, in the dilemma one action involves the resolution choice (sacrifice/intervention), and the other action involves the resolution rejection (no sacrifice/intervention). Incidental dilemmas portray situations where sacrifice occurs as an unintended consequence of saving others, whereas instrumental dilemmas involve sacrifice as an intended means to save others. Filler dilemmas encompass moral issues excluding killing (Lotto et al., 2014). Half of the selected incidental and instrumental dilemmas involve a risk for the participant in the story, and the resolution is aimed at saving the own life together with other people's lives (dilemmas with involvement/self), while the other half does not (dilemmas without involvement/others). For each type of dilemma (self-incidental, others-incidental, self-instrumental, others-instrumental, filler), resolution indexes (RIs; i.e. sacrifice rates) are calculated as the number of total resolution choices (affirmative response to the question about

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applying or not the proposed resolution, i.e., the sacrifice), yielding five 4-point (range: 0-3) variables (one for each dilemma type). Additionally, moral acceptability for each dilemma (referred to as "moral judgement" with the question "How morally acceptable the dilemma resolution is?") was rated on an 8-point (range: 0-7) Likert-like scale. Emotional valence ("How much pleasantness did you experience reading the dilemma?"), and arousal ("How much activation did you experience reading the dilemma?") experienced during decision-making were rated on 9-point (range: 1-9) Likert-like scales. The complete list of variables for each dilemma type and involvement is shown in table 1. The original set of moral dilemmas can be found at: https://www.dpss.unipd.it/dpss-research-materials, while the selected subset was uploaded to the Open Science Framework (OSF) online repository (HTTPS://DOI.ORG/10.17605/OSF.IO/P7JZ2).

Dilemma Type	Involvement	Measures for each dilemma
Incidental	With involvement/Self	• Resolution index (4-point count variable) • Moral judgement (8-point Likert-like scale) • Emotional valence (9-point Likert-like scale) • Arousal (9-point Likert-like scale)
	Without involvement/Others	
Instrumental	With involvement/Self	
	Without involvement/Others	
Filler	/	

Table 1. List of variables measured for each type of dilemma. Resolution index is the number of total sacrifice choices, ranging between 0 and 3.

The *State-Trait Anxiety Inventory form Y (STAI- Y)* (Spielberger, 1999), a 4-point Likert scale (1-to-4) consisting of 40 items and is divided into two parts: the first 20 items assess state anxiety, referring to the psychophysiological condition at a given moment, while the other 20 items measure trait anxiety. Good internal consistency is reported for both, state and trait anxiety subscales of the STAI, with Cronbach's α coefficients ranging from 0.91-0.95 and 0.85-0.90, respectively (Spielberger, 1999).

The *Multidimensional Assessment of Interoceptive Awareness – Version 2 (MAIA-2)* (Mehling et al., 2018), is a state-trait self-report questionnaire (6-point Likert scale, 0-to-5) to measure multiple dimensions of interoception (awareness of bodily sensations). It consists of 37 items grouped into 8 scales: Noticing, Not-Distracting, Not-Worrying, Attention Regulation, Emotional Awareness, Self-Regulation, Body Listening, and Trust. Cronbach's α for the eight scales ranges from 0.64 to 0.83 (Mehling et al., 2018). The Italian version of the scale was employed, which has a Cronbach's α for the eight subscales ranging between 0.53 and 0.80 (Calì et al., 2015).

The *Social and Economic Conservatism Scale (SECS)* (Everett, 2013), is a 0-100 thermometer scale designed to measure support for so-called "peripheral" aspects of conservatism by employing two subscales: a 5-item economical conservatism subscale and a 7-item social conservatism subscale. It is composed of 12 items. Reliability analyses confirmed internal consistency, with a good overall Cronbach's α = 0.88 for the complete 12-item scale, a

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Cronbach's α=.70 for the economic conservatism subscale, and a Cronbach's α= .87 for the social conservatism subscale (Everett, 2013).

The *Trait Fear-55 (TF-55)* (Kramer et al., 2012) is a questionnaire that includes a series of 55 items from other verified measures to measure the amount of a person's fear as a personality trait. The internal consistency of the items is excellent (Cronbach's α = .96) (Kramer et al., 2012).

Ad hoc single-item *7-point Likert Political Orientation scale*. The participant had to respond to the question "What is your political orientation in a scale ranging from 1=extreme left to 7=extreme right?". In the Political Orientation scale participants were also allowed to respond, "I do not know/I do not want to respond".

We performed a forward-back translation procedure for scales not available in a validated Italian version (Bontempo, 1993; Tsang et al., 2017), which were the *SECS* (Everett, 2013) and the *Misinformation Susceptibility Scale about COVID-19* (Roozenbeek et al., 2020) scales. First, three separate forward translations were generated by Italian native-speakers proficient in English. These translators (one was an author of the present study (M.L.S.), and the other two are authors in a related study of our group), with a background in Psychology but lacking familiarity with the constructs, produced three provisional Italian versions. Subsequently, two Italian native-speaker authors proficient in English (A.C. and Si.M.) who were familiar with the constructs, compared the three versions item by item. After reaching a consensus, a provisional Italian version was formulated. Following this, an English native-speaker and translator, proficient in Italian, but without a background in Psychology and unfamiliar with the constructs, performed the back-translation into English. Any discrepancies between the original English version and the back-translation were then identified, discussed, and resolved within the research group. The final Italian version received consensus approval from the same researchers involved in previous stages. The materials of the translation process were uploaded in the OSF online repository (HTTPS://DOI.ORG/10.17605/OSF.IO/P7JZ2).

Data collection

Data were collected online through the site Google Forms (https://docs.google.com/forms/). After demographic data collection, the questionnaires and the moral dilemmas were presented in random order. All scored data were uploaded in the OSF online repository (see Data Availability Statement section).

Data Analysis

Data were extracted in Excel format from Google Forms and tabulated for data analysis. The significance level was set at $p < .05$ for all statistical tests. All analyses were conducted using the statistical software R (R Developement Core Team, 2023) with the Psych package (Revelle, 2023) and the statistical software Jamovi (*The jamovi project-jamovi.*, 2023) with the GAMLj module (https://gamlj.github.io/index.html).

A "Hesitancy_Quart" dichotomic variable was created by selecting the extreme quartiles of the VHS distribution for assessing a difference in the selected groups as done in precedent studies (Vicario et al., 2023). To assess normal distribution of the variables, Shapiro-Wilk tests

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on the whole dataset were computed. Since most variables did not show a normal distribution, we performed Spearman correlations with Bonferroni correction for multiple comparisons for the whole dataset, a series of non-parametric tests, and a series of Generalized Linear Model (GzLM) tests.

For the correlation tests (see in next paragraph), outliers (i.e., values above +/- 1.5 IQR from the 25th and 75th percentiles as computed by the boxplot function performed in R) were removed (detailed N for each correlation is shown in complete data analysis file uploaded to the OSF website.

Moral dilemmas

Four non-parametric Friedman tests were computed with dependent variables RI, moral judgement, emotional valence, and arousal to compare the five different dilemma types: incidental self, incidental others, instrumental self, instrumental others, and filler.

Since the data did not meet GLM assumptions (particularly normality of the distribution), five non-parametric Mann-Whitney tests were computed with the dichotomic variable "Hesitancy_Quart" as a factor (High VH, Low VH), and the five different RIs (number of accepted resolutions) as dependent variables for testing whether there was a difference between high and low hesitance individuals. Since the data did not meet GLM assumptions (particularly normality of the distribution and homoscedasticity), five moderated regression tests with GzLM were computed by assuming a gamma distribution (which fits with right-skewed and heteroscedastic distributions) and a logarithmic link function (Nelder & Wedderburn, 1972; Ng & Cribbie, 2017, 2019).

For each test (one for each dilemma type independently), we included the relative RI, the misinformation susceptibility score (that we considered as a moderator), and the interaction between them as predictors, controlled for relative moral judgement, emotional valence, and arousal as covariates, and defined VHS as predicted variable for testing whether moral dilemma scores had a predictive role for VH.

For the interpretation of the statistically significant moderations, we decided to employ simple slope analyses from the GAMLj module, since they compute the effects controlling for the covariate scores.

We also computed estimated marginal means and 95% CIs for all the predictors and covariates (see in the "complete analyses" file uploaded to the OSF online repository.) (Fidler & Cumming, 2018; Garofalo et al., 2022). All predictors and covariates were centered to the mean.

MFQ. Six non-parametric Mann-Whitney tests were computed with the dichotomic variable "Hesitancy_Quart" as a factor (High VH, Low VH), and MFQ subscores as dependent variables.

Results

Descriptive statistics and frequency tables are provided in table 2 and 3.

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Descriptives statistics

				95% Confidence Interval			
	N	Mean	SD	Lower	Upper	Median	SE
Age	100	24.5	6.867	23.154	25.846	22.5	0.687
aVHS	100	23.77	9.261	21.955	25.585	23	0.926
Misinformation	100	2.267	1.066	2.058	2.476	2	0.107
Others_Incidental_Resolution_Index	100	1.96	1.163	1.732	2.188	2	0.116
Others_Incidental_Moral_Judgement	100	1.8	1.838	1.44	2.16	1.167	0.184
Others_Incidental_Valence	100	2.047	1.459	1.761	2.333	1	0.146
Others_Incidental_Arousal	100	5.893	2.619	5.38	6.407	6	0.262
Others_Instrumental_Resolution_Index	100	0.99	1.227	0.75	1.23	0	0.123
Others_Instrumental_Moral_Judgement	100	1.867	2.067	1.461	2.272	1.167	0.207
Others_Instrumental_Valence	100	2.26	1.667	1.933	2.587	1.5	0.167
Others_Instrumental_Arousal	100	5.707	2.595	5.198	6.215	6	0.259
Self_Incidental_Resolution_Index	100	2.18	1.158	1.953	2.407	3	0.116
Self_Incidental_Moral_Judgement	100	1.767	1.98	1.379	2.155	1	0.198
Self_Incidental_Valence	100	2.127	1.508	1.831	2.422	1.333	0.151
Self_Incidental_Arousal	100	6.277	2.573	5.772	6.781	6.667	0.257
Self_Instrumental_Resolution_Index	100	1.1	1.275	0.85	1.35	0	0.128
Self_Instrumental_Moral_Judgement	100	1.787	2.039	1.387	2.186	1	0.204
Self_Instrumental_Valence	100	2.387	1.766	2.041	2.733	1.667	0.177
Self_Instrumental_Arousal	100	6.137	2.533	5.64	6.633	6.333	0.253
Filler_Resolution_Index	100	1.17	1.064	0.961	1.379	1	0.106
Filler_Moral_Judgement	100	2.93	2.063	2.526	3.334	2.833	0.206
Filler_Valence	100	4.193	2.054	3.791	4.596	4.333	0.205
Filler_Arousal	100	3.887	2	3.495	4.279	3.667	0.2
MAIA-2	100	2.936	0.67	2.805	3.068	2.82	0.067
MAIA-2_1	100	3.402	1.151	3.177	3.628	3.5	0.115
MAIA-2_2	100	2.08	1.093	1.866	2.294	1.83	0.109
MAIA-2_3	100	2.604	1.036	2.401	2.807	2.6	0.104
MAIA-2_4	100	3.034	0.934	2.851	3.217	3.14	0.093
MAIA-2_5	100	3.672	1.089	3.459	3.885	4	0.109
MAIA-2_6	100	2.79	1.154	2.564	3.016	2.5	0.115
MAIA-2_7	100	2.849	1.246	2.605	3.093	3	0.125
MAIA-2_8	100	3.059	1.253	2.813	3.305	3	0.125
MFQ	92	19.011	3.008	18.396	19.626	19	0.314
MFQ1	94	22.489	3.809	21.719	23.259	22	0.393
MFQ2	95	22.368	3.759	21.613	23.124	23	0.386
MFQ3	99	18.212	4.399	17.346	19.079	18	0.442
MFQ4	99	15.152	5.384	14.091	16.212	15	0.541
MFQ5	100	15.47	5.885	14.317	16.623	15	0.589
SECS	100	57.828	14.016	55.081	60.575	58.3	1.402
Stai-Y_Trait	100	47.65	11.95	45.308	49.992	48	1.195
Stai-Y_State	100	42.31	12.665	39.828	44.792	41	1.266
Trait_Fear	100	58.53	19.36	54.735	62.325	58.5	1.936

Table 2. Descriptive statistics of the entire dataset. MFQ1=Care/Harm; MFQ2=Fairness/Cheating; MFQ3=Loyalty/Betrayal; MFQ4=Authority/Subversion; MFQ5=Sanctity/Degradation. MAIA-2_1=Noticing, MAIA-2_2=Non-Distracting, MAIA-2_3=Not-Worrying, MAIA-2_4=Attention Regulation, MAIA-2_5=Emotional Awareness, MAIA-2_6=Self-Regulation, MAIA-2_7=Body Listening, MAIA-2_8=Trusting.

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Frequencies table

Levels		N	%	Cumulative %
Gender				
	Other	4	4.0 %	4.0 %
	Females	43	43.0 %	47.0 %
	Males	53	53.0 %	100.0 %
Job				
	Workers	40	40.0 %	40.0 %
	Students	59	59.0 %	99.0 %
	Worker-Students	1	1.0 %	100.0 %
Political orientation				
	Extreme left	4	7.5 %	7.5 %
	Left	13	24.5 %	32.1 %
	Center-Left	12	22.6 %	54.7 %
	Center	8	15.1 %	69.8 %
	Center-Right	8	15.1 %	84.9 %
	Right	7	13.2 %	98.1 %
	Extreme Right	1	1.9 %	100.0 %

Table 3. Frequencies table of the entire dataset (qualitative variables).

Spearman's correlations computed with Bonferroni corrections for multiple tests yielded ten statistically significant correlations (excluding same-questionnaire subscale correlations).

None of the MFQ subscales correlated significantly with any moral dilemma RI or with VHS. Additionally, none of the moral dilemma RIs correlated with the VHS. All relevant correlations are shown in Table 4

Spearman's correlation	r	N	p (Bonferroni)	Significance
VHS - Misinformation	0.571	100	<.001	***
MFQ1 - Others Incidental Valence	-0.430	100	.012	*
MFQ1 - Others Incidental Arousal	0.476	100	.001	**
MFQ1 - Self Incidental Valence	0.523	100	.001	**
MFQ1 - Self Instrumental Valence	-0.480	100	.001	**
MFQ2 - Others Incidental Arousal	0.408	100	.033	*
MFQ2 - Self Incidental Valence	-0.558	100	<.001	***
MFQ2 - Self Incidental Arousal	0.435	100	.008	**
MFQ2 - Self Incidental Valence	-0.457	100	.004	**
MFQ2 - Self Incidental Arousal	0.424	100	.015	*

Table 4. Main Spearman's correlations which survived Bonferroni correction for multiple tests. MFQ1 refers to thecare/harm, whereas MFQ2 refers to fairness/cheating subscale. VHS=vaccine hesitancy scale; MFQ=moral foundation questionnaire. Statistically significant differences are marked with asterisks.

The full Correlation matrix is provided in the "complete analyses" file uploaded in OSF website.

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Moral Dilemma models.

The five non-parametric Mann-Whitney tests showed statistically significant differences between High and Low Hesitancy individuals in Self -Incidental RI (*U*=243.000, p=.026, effect size=.306) as individuals with low VH show higher self-incidental RIs than high VH ones. No effects were observed for Others-Incidental (*U*=253.000, p=.063, effect size=.277), Others-Instrumental (*U*=335.000, p=.771, effect size=.043), Self -Instrumental (*U*=334.500, p=.921, effect size=.016), and Filler RIs (*U*=248.000, p=.059, effect size=.291). The mean and median plots for the Mann-Whitney tests are presented in Figure 1

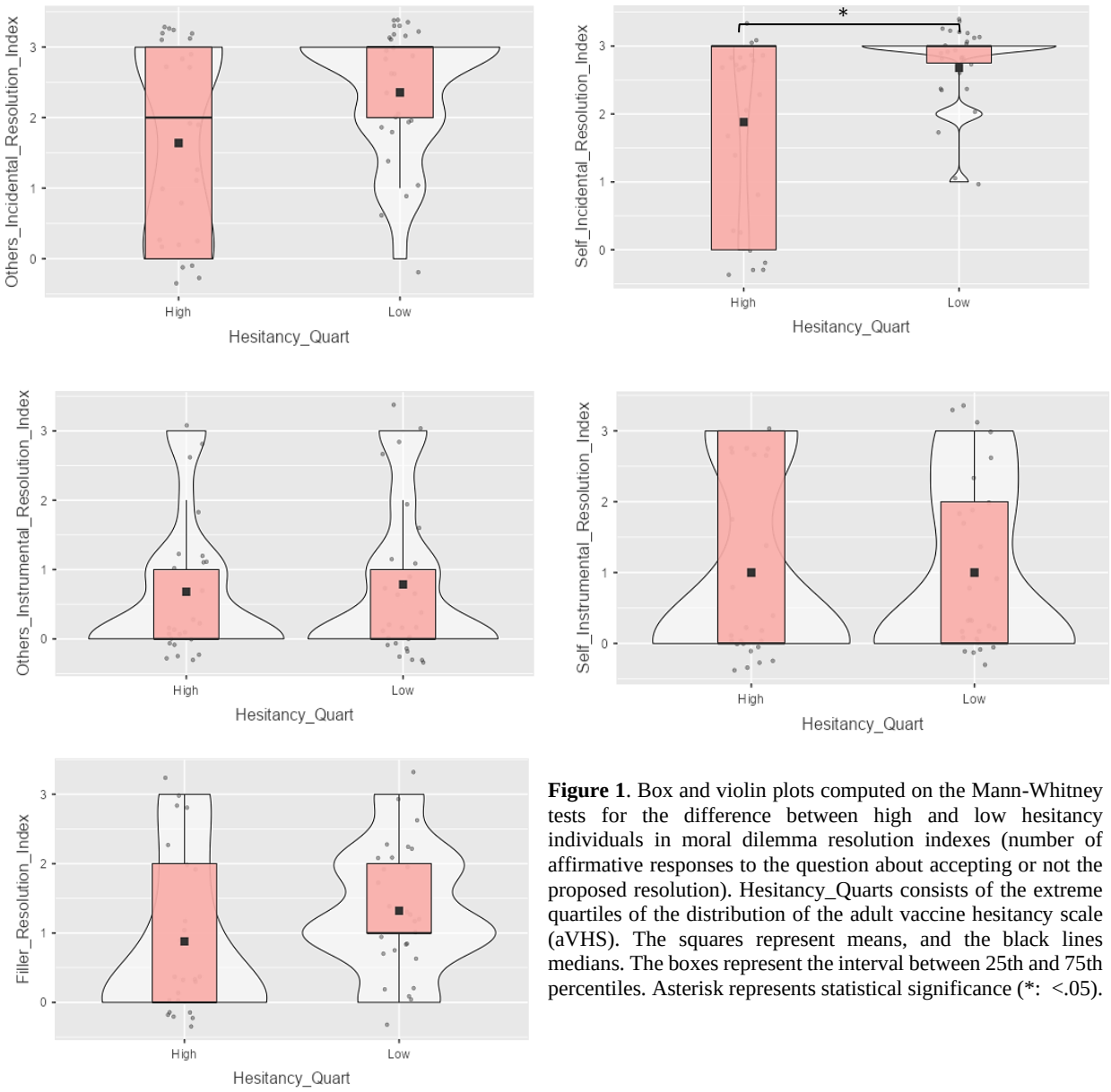

Figure 1. Box and violin plots computed on the Mann-Whitney tests for the difference between high and low hesitancy individuals in moral dilemma resolution indexes (number of affirmative responses to the question about accepting or not the proposed resolution). Hesitancy_Quarts consists of the extreme quartiles of the distribution of the adult vaccine hesitancy scale (aVHS). The squares represent means, and the black lines medians. The boxes represent the interval between 25th and 75th percentiles. Asterisk represents statistical significance (*: <.05).

The five GzLM tests are described below:

Model 1 involved Others-Incidental RI, Misinformation susceptibility (we will refer to it simply as “misinformation” in results section) and the interaction between them as predictors, Others-Incidental morality evaluation, Others-Incidental Valence, and Others-Incidental Arousal as

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covariates, and VHS as the dependent variable, resulting in a statistically significant conditional effect of Misinformation [$X^2(1)=26.332$, $p < .001$], and Others-Incidental RI [$X^2(1)=7.794$, $p = .005$], and an interaction between Others-Incidental RI and Misinformation on VHS [$X^2(1)=5.314$, $p = .021$]. Misinformation and Others-Incidental RI are independent (no multicollinearity), since they do not statistically correlate significantly ($r = -.057$, $p_{Bonferroni} = 1$, $p = .578$).

Specifically, the simple effects/slopes analysis (computed maintaining the covariates constant at the mean) shows that the negative effect of Others Incidental RI on VHS is statistically significant in participants with low levels [-1SD: $X^2(1) = 11.749$, $p < .001$] and average levels [Mean: $X^2(1)= 7.565$, $p = .006$], but not high levels of Misinformation [+1SD: $X^2(1) = 0.259$, $p = .611$]. The regression slopes (and 95% CIs) for the three groups are shown in Figure 2, and the simple effects and 95% CIs (computed maintaining constant the covariates at the mean) are shown in Table 5. The model accounted for 34% of VHS variance.

Simple effects of Others_Incidental_Resolution_Index : Parameter estimates

Moderator levels			**95% Confidence Interval**			
Misinformation	**Estimate**	**SE**	**Lower**	**Upper**	**z**	**p**
Mean-1-SD	-0.152	0.044	-0.238	-0.065	-3.428	< .001
Mean	-0.086	0.031	-0.147	-0.025	-2.75	0.006
Mean+1-SD	-0.02	0.04	-0.099	0.058	-0.508	0.611

Note. Simple effects are estimated keeping constant other independent variable(s) in the model

Table 5. Simple effects/slopes table for the Model 1**.** Estimated effects and 95% CIs are computed maintaining constant the covariates at the mean. Simple slopes analysis shows the estimated effect of the independent variables at different levels of the moderator.

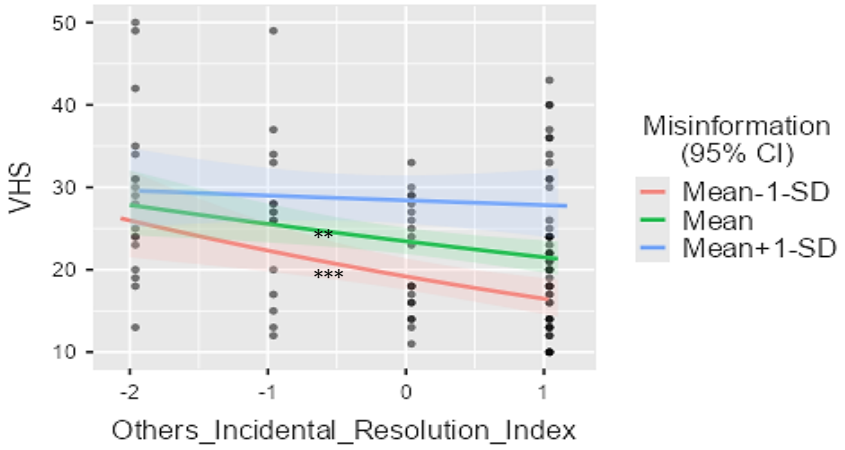

Figure 2. Regression slopes for the Model 1. In blue the effect of Orhers-Incidental Resolution Index (RI) on vaccine hesitancy scale (VHS) at +1SD from the mean, in green at average levels, and in red at -1SD from the mean of misinformation susceptibility about COVID-19. The colored halos represent the CIs on the slope. **: p<.01; ***: p<.001.

Model 2 involved Self-Incidental RI, Misinformation, and the interaction between them as predictors, Self-Incidental morality evaluation, Self-Incidental Valence, Self-Incidental Arousal as covariates, and VHS as the dependent variable, resulting in a statistically significant conditional effect of Misinformation

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[$X^2(1)=26.865$, $p < .001$], Self-Incidental RI [$X^2(1)=8.244$, $p = .004$], and Self-Incidental Arousal [$X^2(1)=3.977$, $p = .046$], and an interaction between Self-Incidental RI and Misinformation on VHS [$X^2(1)=9.539$, $p = .002$]. Misinformation and Self-Incidental RI are independent, since they do not exhibit statistically significant correlation ($r = -.193$, $p_{Bonferroni} = 1$, $p = .056$).

Specifically, the simple effects/slope analysis (computed maintaining the covariates constant at the mean) shows that the negative effect of Self- Incidental RI on VHS is statistically significant in participants with low levels [-1SD: $X^2(1) = 13.947$, $p < .001$] and average levels [Mean: $X^2(1)= 7.913$, $p = .005$], but not high levels of Misinformation [+1SD: $X^2(1) = 0.053$, $p = .818$]. The regression slopes (and 95% CIs) for the three groups are shown in Figure 3, and the simple effects and 95% CIs (computed maintaining constant the covariates at the mean) are shown in Table 6. The model accounted for 36% of the variance of VHS.

Simple effects of Self_Incidental_Resolution_Index: Parameter estimates

Moderator levels			**95% Confidence Interval**			
Misinformation	**Estimate**	**SE**	**Lower**	**Upper**	**z**	**p**
Mean-1-SD	-0.17	0.045	-0.258	-0.081	-3.735	< .001
Mean	-0.089	0.032	-0.151	-0.027	-2.813	0.005
Mean+1-SD	-0.008	0.037	-0.08	0.064	-0.231	0.818

Note. Simple effects are estimated keeping constant other independent variable(s) in the model

Table 6. Simple effects/slopes table for the Model 2. Estimated effects and 95% CIs are computed maintaining constant the covariates at the mean. Simple slopes analysis shows the estimated effect of the independent variables at different levels of the moderator

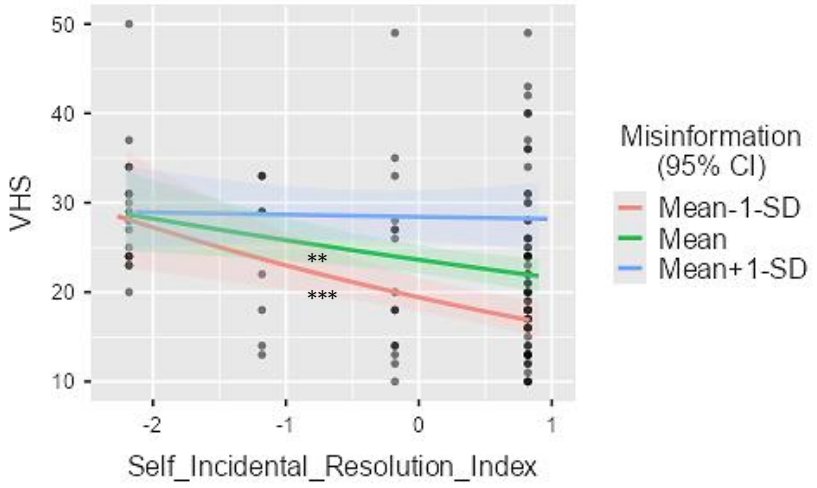

Figure 3 Regression slopes for the Model 2. In blue the effect of Self-Incidental Resolution Index (RI) on vaccine hesitancy scale (VHS) at +1SD from the mean, in green at average levels, and in red at -1SD from the mean of misinformation susceptibility about COVID-19. The colored halos represent the CIs on the slope. **: p<.01; ***: p<.001.

Model 3 involved Others-Instrumental RI, Misinformation, and the interaction between them as predictors, Others-Instrumental morality evaluation, Others Instrumental Others-Instrumental Valence, Others Instrumental Others-Instrumental Arousal as covariates, and VHS as the dependent variable,

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resulting in a statistically significant conditional effect of Misinformation [$X^2(1)=20.792$, $p < .001$], but no interaction between Others-Instrumental RI and Misinformation [$X^2(1)= 0.276$, $p = 599$].

The regression slopes (and 95% CIs) for the three Misinformation groups are shown in Figure 4, and the simple effects and 95% CIs (computed maintaining constant the covariates at the mean) are shown in Table 7. The model accounted for 25.3% of the VHS variance.

Simple effects of Others_Instrumental_Resolution_Index : Parameter estimates

Moderator levels			**95% Confidence Interval**			
Misinformation	**Estimate**	**SE**	**Lower**	**Upper**	**z**	**p**
Mean-1-SD	-0.062	0.049	-0.159	0.035	-1.253	0.21
Mean	-0.043	0.031	-0.103	0.018	-1.387	0.165
Mean+1-SD	-0.024	0.044	-0.11	0.063	-0.535	0.592

Note. Simple effects are estimated keeping constant other independent variable(s) in the model

Table 7. Simple effects/slopes table for Model 3. Estimated effects and 95% CIs are computed maintaining constant the covariates at the mean. Simple slopes analysis shows the estimated effect of the independent variables at different levels of the moderator

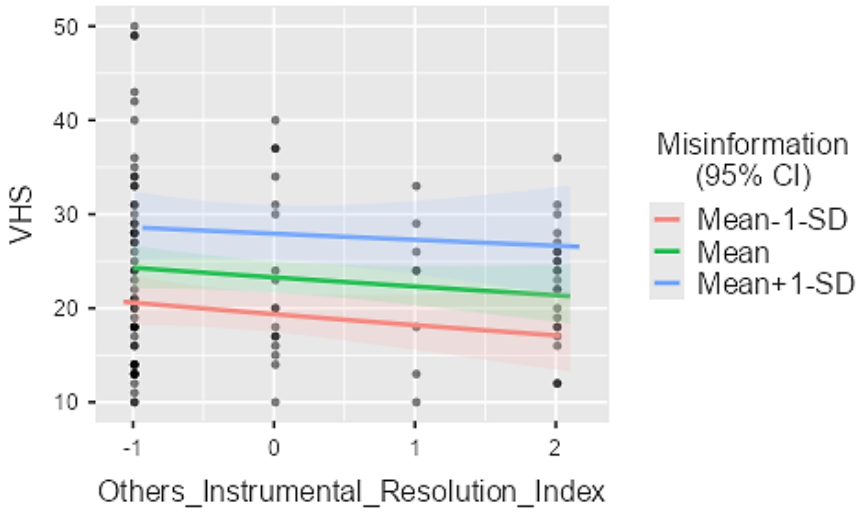

Figure 4. Regression slopes for the Model 3. In blue the effect of Others-Instrumental Resolution Index (RI) on vaccine hesitancy scale (VHS) at +1SD from the mean, in green at average levels, and in red at -1SD from the mean of misinformation susceptibility about COVID-19. Thecolored halos represent the CIs on the slope.

Model 4 involved Self-Instrumental RI, Misinformation, and their interaction as predictors, Self-Instrumental morality evaluation, Self-Instrumental Valence, Self-Instrumental Arousal as covariates, and VHS as the dependent variable, resulting in a statistically significant conditional effect of Misinformation [$X^2(1)=25.196$, $p < .001$], but no statistically significant interactions between Self-Instrumental RI and Misinformation [$X^2(1) = 3.711$, $p = .054$]. The regression slopes (and 95% CIs)

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for the three Misinformation groups are shown in Figure 5, and the simple effects and 95% CIs (computed maintaining constant the covariates at the mean) are shown in Table 8. The model accounted for 29.2% of the VHS variance.

Moderator levels			**95% Confidence Interval**			
Misinformation	**Estimate**	**SE**	**Lower**	**Upper**	**z**	**p**
Mean-1-SD	-0.098	0.043	-0.182	-0.013	-2.261	0.024
Mean	-0.042	0.029	-0.099	0.014	-1.473	0.141
Mean+1-SD	0.013	0.038	-0.061	0.087	0.348	0.728

Note. Simple effects are estimated keeping constant other independent variable(s) in the model

Table 8. Simple effects/slopes table for the Model 4. Estimated effects and 95% CIs are computed maintaining the covariates at the mean constant. The simple slope analysis shows the estimated effect of the independent variables at different levels of the moderator. Because the moderation was not statistically significant, we did not discuss it despite simple slopes show a significant effect in one of the three conditions.

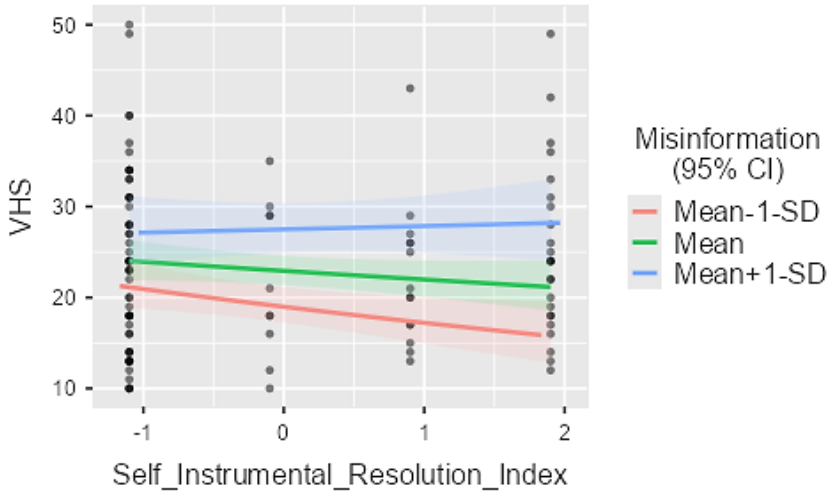

Figure 5. Regression slopes for Model 4. In blue the effect of Self-Instrumental Resolution Index (RI) on vaccine hesitancy scale (VHS) at +1SD from the mean, in green at average levels, and in red at -1SD from the mean of misinformation susceptibility about COVID-19. The colored halos represent the CIs on the slope.

Model 5 involved Filler RI, Misinformation, and their interaction as predictors, Filler morality evaluation, Filler Valence, and Filler Arousal served as covariates, and VHS as dependent variable, resulting in a statistically significant conditional effect of Misinformation [$X^2(1)=25.877$, $p < .001$], Filler RI [$X^2(1)=4.167$, $p = .041$] but no statistically significant interactions between Misinformation and Filler RI [$X^2(1)=3.814$, $p = .051$]. The regression slopes (and 95% CIs) for the three Misinformation groups are shown in Figure 6, and the simple effects and 95% CIs (computed

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maintaining constant the covariates at the mean) are shown in Table 9. The model accounted for 29.3% of the VHS variance.

Simple effects of Filler_Resolution_Index : Parameter estimates

Moderator levels			**95% Confidence Interval**			
Misinformation	**Estimate**	**SE**	**Lower**	**Upper**	**z**	**p**
Mean-1-SD	-0.129	0.051	-0.228	-0.03	-2.551	0.011
Mean	-0.07	0.035	-0.139	-0.001	-1.975	0.048
Mean+1-SD	-0.01	0.043	-0.094	0.074	-0.233	0.816

Note. Simple effects are estimated keeping constant other independent variable(s) in the model

Table 9. Simple effects/slopes table for the Model 5**.** Estimated effects and 95% CIs are computed maintaining constant the covariates at the mean. Simple slopes analysis shows the estimated effect of the independent variables at different levels of the moderator. Because the moderation was not statistically significant, we did not discuss it despite simple slopes show a significant effect in two of the three moderator levels.

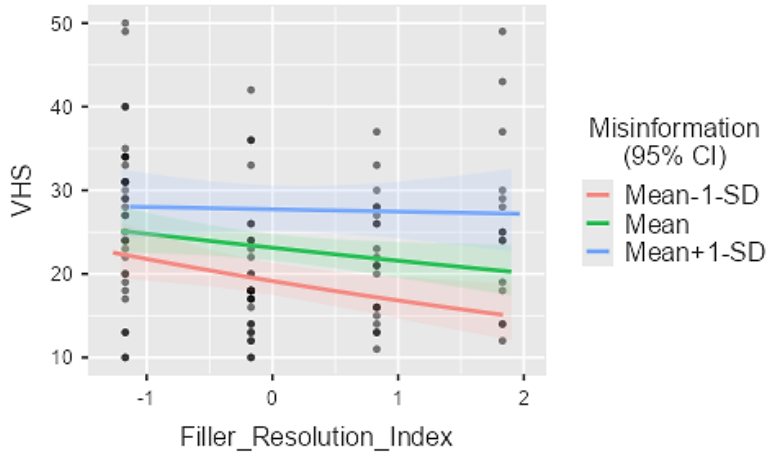

Figure 6. Regression slopes for the Model 5. In blue the effect of Self-Instrumental Resolution Index (RI) on vaccine hesitancy scale (VHS) at +1SD from the mean, in green at average levels, and in red at -1SD from the mean of misinformation susceptibility about COVID-19. The colored halos represent the CIs on the slope.

MFQ models. The five non-parametric Mann-Whitney tests showed statistically significant differences between high and low hesitancy individuals in the MFQ 4-Authority/Subversion (*U*=227.500, p=.044, effect size=.326), but not in the MFQ-general (*U*=222.500, p=.128, standardized effect size=.256), MFQ 1-Care/Harm (*U*=307.500, p=.790, standardized effect size=.045), MFQ 2-Fairness/Cheating (*U*=228.500, p=.111, standardized effect size=.264), MFQ 3-Loyalty/Betrayal (*U*=318.500, p=.580, effect size=.090), and MFQ 5-Sanctity/Degradation scores (*U*=251.000, p=.079, standardized effect size=.283). The box and violin plots for the Mann-Whitney tests are presented in Figure 7.

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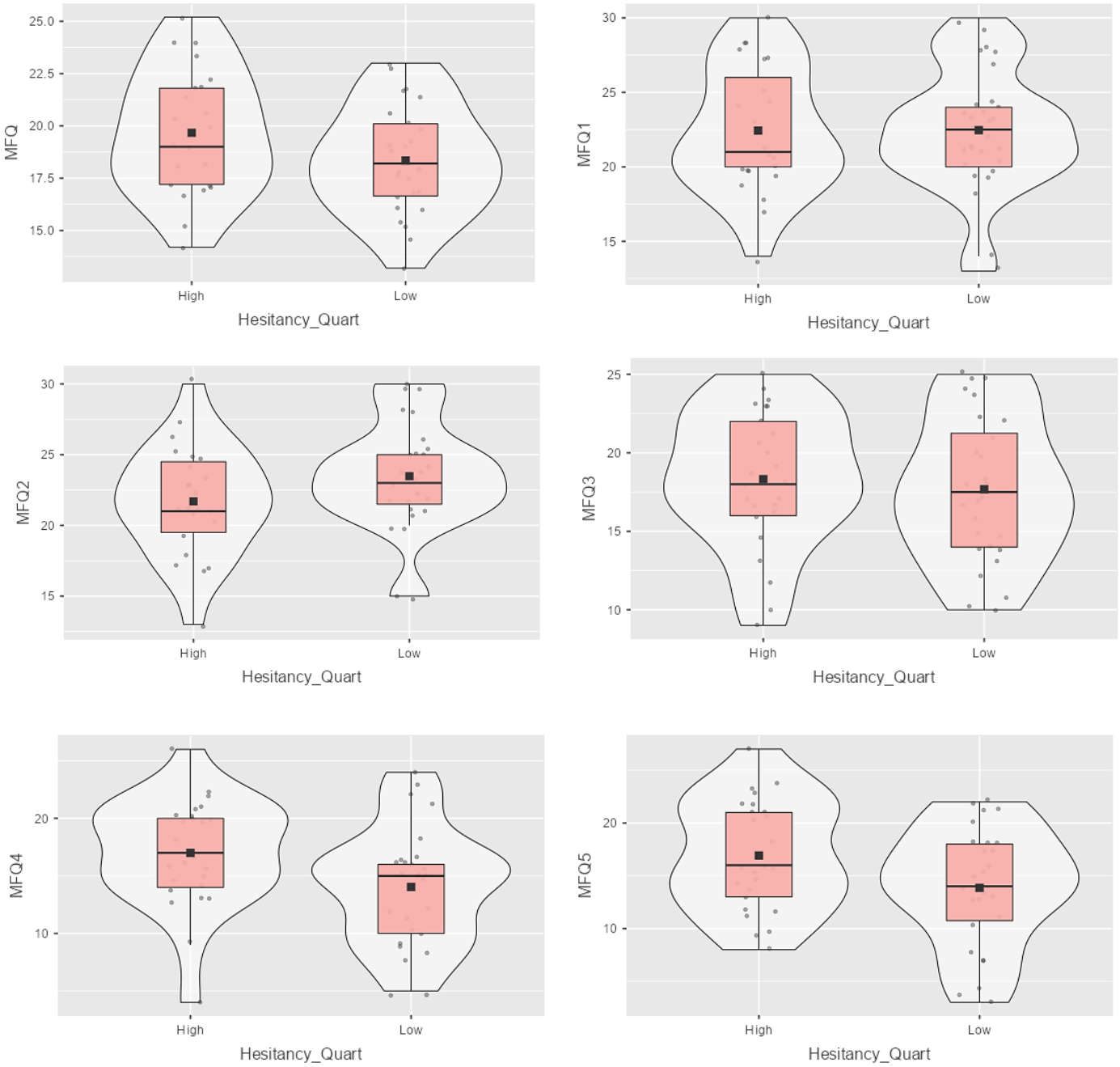

Figure 7. Box and violin plot computed on the Mann-Whitney tests for the difference between high and low hesitancy individuals in moral foundation questionnaire (MFQ) general score and subscales. The squares represent means, and the black lines medians. The boxes represent the interval between 25th and 75th percentiles. Only MFQ4 exhibit differences between high and low hesitancy individuals. Hesitancy Quart consists of extreme quartiles of vaccine hesitancy scale's (VHS) distribution. MFQ1=Care/Harm; MFQ2=Fairness/Cheating; MFQ3=Loyalty/Betrayal; MFQ4=Authority/Subversion; MFQ5=Sanctity/Degradation. Asterisk represents statistical significance (*: <.05).

The complete analyses have been uploaded in the OSF online repository (HTTPS://DOI.ORG/10.17605/OSF.IO/P7JZ2).

Discussion

Our findings highlight the relationship between VH and decision-making in moral dilemmas (hypothesis i), as individuals with high VH scores (the fourth quartile of our distribution) tend to be

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more rigid (i.e., they tend to refuse the sacrifice) than those with low VH scores (the first quartile of our distribution) when facing incidental moral violations with involvement ("self") (standardized effect size: .306). This result was not obtained for instrumental and filler dilemmas, as well as for incidental without personal involvement of the participant (i.e., the self-involvement condition). An important implication of this finding is that, within the framework of incidental moral dilemmas, such as the scenario of deciding whether to press a key to save a large group of people while sacrificing a smaller group, individuals with high scores of vaccine hesitancy may prioritize moral reasons against intervention (such as avoiding harm) over moral reasons for intervention (such as seeking the greater good) when they are involved in the consequences of that decision. In simple terms, they prioritize absolute moral criteria over pragmatic ones (Kahane, 2015).

Conversely, in instrumental moral dilemmas (intentionally and directly cause the death of a small number of people for saving a larger amount), both vaccine-hesitant and non-hesitant individuals tend to opt for non-intervention. The deliberate and direct nature of the action in instrumental dilemmas is likely seen as morally unacceptable by most individuals (Lotto et al., 2014). Furthermore, the three different dilemma types (i.e., incidental, instrumental and filler) could reflect the involvement of different moral intuitions, or the combination of different moral, cognitive, and affective processes (Kahane, 2015). Moreover, our results shed light on the predictive role of moral decision-making processes and misinformation susceptibility about COIVD-19 on VH (hypothesis ii). Notably, our analysis revealed a moderation effect of misinformation susceptibility levels on the negative relationship between the Incidental RI (both "self" and "other" versions) and Vaccine Hesitancy (VHS) (hypothesis iii). In summary, among individuals with moderate-to-low (but not high-) levels of misinformation susceptibility about COVID-19, a higher tendency to accept sacrifice in incidental moral dilemmas is associated with lower VH.

Interestingly, the moral judgement of the dilemma resolution as well as Valence and Arousal did not affect the model results, suggesting no confounding effects of moral and affective processes on the moderation effect.

These results suggest a distinction between individuals who are highly susceptible to misinformation about COVID-19 and less susceptible ones in their attitudes toward vaccines. Essentially, individuals less susceptible to COVID-19 misinformation, adhering to rigid moral principles like 'not sacrificing one to save many' would show a similar rigidity in vaccine decision-making to 'not sacrificing personal freedom and a few lives to save many lives'. Conversely, this pattern does not manifest in individuals more susceptible to misinformation, who may base their VH on the information they have received, believing vaccines are dangerous or ineffective, and that COVID-19 is not that dangerous (Caserotti et al., 2023; Garett & Young, 2021; Kricorian et al., 2022; Loomba et al., 2021; Neely et al., 2022; Roozenbeek et al., 2020).

These findings align with the results of Nichols and Mallon's study (Nichols & Mallon, 2006), illustrating that many people consider actions that violate moral rules as permissible, avoiding strict adherence to absolute deontological principles. Our results, particularly regarding incidental moral dilemmas, support this observation. Furthermore, our results do not assert that individuals with low misinformation susceptibility levels show a straightforward negative relationship between utilitarian behaviour (as opposed to moral judgement) in sacrificial dilemmas and VH, since moral dilemma

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resolution entails more than simple utilitarianism, involving a complex evaluation of conflicting moral considerations (Gawronski & Beer, 2016; Kahane, 2015).

Decisions related to vaccination can, under specific circumstances, present a moral dilemma for the decision-maker. This dilemma focuses on the need to decide between a significant number of people who may be at risk of succumbing to COVID-19 infection and a smaller group of individuals who might potentially experience severe side effects from the vaccines (Ale et al., 2023; Clarkson & Jasper, 2022). Specifically, we interpreted that the previous scenario applies to well-informed individuals, while people with incorrect information might not view it in the same way. Hence, highly misinformed individuals could believe that the benefits of vaccination do not outweigh the risks. Therefore, for them, the vaccine decision may not represent a moral dilemma (intended as an equal competition between moral alternatives), since information they believe to are biased, leading to a non-involvement of moral processes usually implicated in moral dilemmas.

Unlike moral decision-making, moral judgement did not exert a significant influence in this evaluation, since all participants might agree on the moral inappropriateness of the sacrifice. However, further investigation in larger samples representative of the general population is needed, as well as an investigation directly involving COVID-19 VH and vaccine adherence, to confirm (or confute) our interpretation.

Contrary to previous literature (Amin et al., 2017; Betsch & Böhm, 2018; Pizza et al., 2023; Schmidtke et al., 2022), participants with high (vs. low) VH exhibit higher scores in the MFQ Authority/Subversion subscale, indicating a higher endorsement of authoritarianism in individuals with high VH (standardized effect size: .326) (hypothesis iiii). These discrepancies could be due to the use of different VH measures, as Amin et al. (Amin et al., 2017) and Betsch et al. (Betsch & Böhm, 2018) employed the Parent Attitudes about Childhood Vaccines short scale (Opel et al., 2011), referring not to the participants themselves as the affected individuals, but to their children. In contrast, Schmidtke et al. (2022) used the General Vaccine Hesitancy Scale (Luyten et al., 2019), which refers to the adult participants as affected individuals. Additionally, both contributions applied a subdivision of groups based on VH score cutoffs, while we applied the extreme quartiles of the distribution as criterion since our distribution is right skewed, and we privileged group balancing over external cutoff strategy. This difference of VH groups may be relevant, since we found generally low VH scores in our sample. For example, Schmidtke et al. (2022) reported a VH mean of 36.17 with a range of 9-45. In our study, despite having a similar range (10-50) we found a mean of 23.77.

Finally, the statistical analyses differed between studies. Amin and coworkers, and Betsch and coworkers used MFQ scores as a predictor, and VH as predicted variable, and applied a logistic regression approach. Additionally, we did not observe statistically significant differences in Sanctity/subversion foundation scores between individuals with high and low VH. It is possible that the young age of our sample biased the results since they do not represent the entire population.

Our study confirmed a positive association between misinformation susceptibility about COVID-19 and VH. In particular, higher levels of misinformation susceptibility about COVID-19 are associated with higher levels of VH. This association could be explained by the study of Hampton et al. (Hampton, 2014), who found that vaccine-hesitant individuals are more “passive” in receiving and accepting news. The significant positive correlation between misinformation susceptibility about COVID-19 and VH is consistent with earlier studies (Kricorian et al., 2022; Loomba et al., 2021; Roozenbeek et al., 2020). The present study used a general aVHS (Shapiro et al., 2018), relating it to

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misinformation about a specific virus (COVID-19). Nonetheless, earlier research has highlighted a strong correlation between general VH and intentions related to COVID-19 vaccination, which may shed light on the observed association between general VH and misinformation about COVID-19 (Schmidtke et al., 2022).

Conclusion and implications

VH is a complex and multidimensional issue influenced by multiple factors (Dubé et al., 2013): political (i.e., political polarization and anti-expert populism), societal (i.e., poor social and institutional trust), socioeconomic (i.e., low income), and psychological factors (i.e., reactance, individualistic/hierarchical worldviews, intellectual humility, philosophical, and religious beliefs) (Charron et al., 2023; Lalot et al., 2022; Hornsey et al., 2018; Huynh & Senger, 2021; Murphy et al., 2021).

Our results show how some components of explicit moral appraisal such as moral decision-making may serve as a predictor of the individual approach towards vaccines in a young adult sample in a country that a few years ago underwent the COVID-19 pandemic.

The COVID-19 pandemic has brought about significant changes in social structures and community practices (Francis & McNabb, 2022), giving rise to new behavioral norms based on moral principles, including practices like maintaining physical distance and wearing masks to block virus transmission. The pandemic has confronted individuals with various moral dilemmas. For instance, individuals have grappled with the moral acceptability of imposing restrictions on elderly parents or making vaccine decisions, such as whether the benefits of vaccination outweigh the risks. These situations have created tensions as individuals seek to balance their moral priorities with the imperative to limit the spread of COVID-19 (Prosser et al., 2020). Nevertheless, several studies pointed out that moralization of prevention and restrictive measures for COVID-19 fighting could be counterproductive for some portions of the population of Western Countries, hindering rather than facilitating persuasive efforts (Pizza et al., 2023; Prosser et al., 2020; Rosenfeld & Tomiyama, 2022). In fact, some authors observed how the spread of content containing moral and emotional themes towards specific hot topics could reinforce self-contained information bubbles, intensifying ideological polarization in discussions related to vaccination rather than social responsibility (Brady et al., 2017).

Our results could have important implications for public communication in vaccine campaigns, since we linked incidental moral dilemmas (causing the death of someone as an indirect effect of deciding to save a higher number of people) to attitudes towards vaccines (causing a risk of death for someone as an indirect effect of deciding to vaccinate and saving a higher number of people by mitigating general virus/COVID-19 death risk). Our results suggest the importance of differentiating communication strategies when targeting informed vs misinformed (about vaccines) people. In particular, we argue that in informed people, moral decision-making plays a crucial role in VH, while in misinformed people, moralization of prevention measures might not be the decisive factor for driving (or mitigating) VH. We suggest that in individuals with high levels of misinformation susceptibility about vaccines, VH could be driven by cost-benefit analysis based on wrong or imprecise information about the risks of vaccines.

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We also suggest that public institutions may put emphasis on the cognitive and moral arguments in support of vaccination (i.e., the utilitaristic argument, the "duty of rescue" moral reason) only for informed people, while focusing on the quality of information and communication transparency for misinformed ones.

The advent of the internet has allowed for the rapid dissemination of information from anti-vaccination activists, especially following the rise of social media platforms such as Facebook and Twitter, enabling anyone to share their vaccination experiences with large audiences (Betsch & Böhm, 2018; Kata, 2010). An analysis of arguments proffered on anti-vaccination websites has found that they turn around the themes of safety and effectiveness, alternative medicine, civil liberties, conspiracy theories, and morality, with a prevalence of misinformation (Kata, 2010).

Further studies should explore how misinformation connects to VH and moral decision-making and design strategies to test the impact of these factors on both informed and misinformed individuals. Assessing the efficacy of communication strategies emphasizing moral utilitarian, moral non-utilitarian, and informational aspects among informed and misinformed populations could provide valuable insights.

Limitations and conclusive remarks

Limitations of the present study include reliance on convenience samples of young university students with notably low VH levels, and potential biases of self-report questionnaires. Future research is needed to validate our findings and further explore the complex interplay between misinformation, moral decision-making, and VH. Moreover, assigning the moderating role to misinformation rather than to dilemma resolution is conjectural due to the absence of existing literature on cause-effect relationships. Hence, replicating this result is crucial to establish its reliability and consistency.

Further research is required to validate our results in larger, more diverse samples and to provide a deeper understanding of the interplay between moral decision-making and VH in both well-informed and misinformed individuals. Future investigations should aim to better elucidate the precursors of VH in individuals who have been vaccinated and those who have not, utilizing methodologies that allow to establish causal relationships between variables.

Author Contributions

C.M.V. contributed to the conception and design of the studies. M.L.S. was responsible for data collection. A.C., C.L. and St.M. were responsible for assistance in data collection. A.C. was responsible for data management and statistical analysis. A.C., Si.M., and M.A.N. were responsible for the drafting and finalization of the manuscript. All authors contributed to the manuscript revision and approved the submitted version.

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Data Availability Statement

All the data are available in the OSF online repository in accordance with open science principles: (HTTPS://DOI.ORG/10.17605/OSF.IO/P7JZ2).

Disclosure Statement

The authors report there are no competing interests to declare.

References

Ale, B. J. M., Slater, D. H., & Hartford, D. N. D. (2023). The ethical dilemmas of risky decisions. *Risk Analysis*, *43*(2), 219–233. https://doi.org/10.1111/risa.13893

Amin, A. B., Bednarczyk, R. A., Ray, C. E., Melchiori, K. J., Graham, J., Huntsinger, J. R., & Omer, S. B. (2017). Association of moral values with vaccine hesitancy. *Nature Human Behaviour*, *1*(12), Articolo 12. https://doi.org/10.1038/s41562-017-0256-5

Bendau, A., Plag, J., Petzold, M. B., & Ströhle, A. (2021). COVID-19 vaccine hesitancy and related fears and anxiety. *International Immunopharmacology*, *97*, 107724. https://doi.org/10.1016/j.intimp.2021.107724

Betsch, C., & Böhm, R. (2018). Moral values do not affect prosocial vaccination. *Nature Human Behaviour*, *2*(12), 881–882. https://doi.org/10.1038/s41562-018-0478-1

Bilewicz, M., & Soral, W. (2022). The Politics of Vaccine Hesitancy: An Ideological Dual-Process Approach. *Social Psychological and Personality Science*, *13*(6), 1080–1089. https://doi.org/10.1177/19485506211055295

Bobbio, A., Nencini, A., Manzotti, R., Moderato, P., Venza, G., Cascio, G., Lo, C., Mattana, V., Loi, M., Grasso, M., & Rubano, C. (2011). *Journal of Psychology (Italy)*.

Bontempo, R. (1993). Translation Fidelity of Psychological Scales: An Item Response Theory Analysis of an Individualism-Collectivism Scale. *Journal of Cross-Cultural Psychology*, *24*(2), 149–166. https://doi.org/10.1177/0022022193242002

Brady, W. J., Wills, J. A., Jost, J. T., Tucker, J. A., & Van Bavel, J. J. (2017). Emotion shapes the diffusion of moralized content in social networks. *Proceedings of the National Academy of Sciences*, *114*(28), 7313–7318. https://doi.org/10.1073/pnas.1618923114

Calì, G., Ambrosini, E., Picconi, L., Mehling, W., & Committeri, G. (2015). Investigating the relationship between interoceptive accuracy, interoceptive awareness, and emotional susceptibility. *Frontiers in Psychology*, *6*. https://www.frontiersin.org/articles/10.3389/fpsyg.2015.01202

Caserotti, M., Girardi, P., Sellaro, R., Rubaltelli, E., Tasso, A., Lotto, L., & Gavaruzzi, T. (2023). To vaccinate or not to vaccinate? The interplay between pro- and against- vaccination reasons. *BMC Public Health*, *23*. https://doi.org/10.1186/s12889-023-17112-6

Charron, N., Lapuente, V., & RODRÍGUEZ-POSE, A. (2023). Uncooperative society, uncooperative politics or both? Trust, polarization, populism and COVID-19 deaths across European regions. *European Journal of Political Research*, *62*(3), 781–805.

ISSN: 3035-062X
2025, 2(1)
Preliminary Reports and Negative Results in Life Science and Humanities

Christie, A., Henley, S. J., Mattocks, L., Fernando, R., Lansky, A., Ahmad, F. B., Adjemian, J., Anderson, R. N., Binder, A. M., Carey, K., Dee, D. L., Dias, T., Duck, W. M., Gaughan, D. M., Lyons, B. C., McNaghten, A. D., Park, M. M., Reses, H., Rodgers, L., … Beach, M. J. (2021). Decreases in COVID-19 Cases, Emergency Department Visits, Hospital Admissions, and Deaths Among Older Adults Following the Introduction of COVID-19 Vaccine—United States, September 6, 2020–May 1, 2021. *Morbidity and Mortality Weekly Report*, *70*(23), 858–864. https://doi.org/10.15585/mmwr.mm7023e2

Clarkson, E., & Jasper, J. D. (2022). Individual differences in moral judgment predict attitudes towards mandatory vaccinations. *Personality and Individual Differences*, *186*, 111391. https://doi.org/10.1016/j.paid.2021.111391

Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013). Vaccine hesitancy. *Human Vaccines & Immunotherapeutics*, *9*(8), 1763–1773. https://doi.org/10.4161/hv.24657

Everett, J. A. C. (2013). The 12 Item Social and Economic Conservatism Scale (SECS). *PLOS ONE*, *8*(12), e82131. https://doi.org/10.1371/journal.pone.0082131

Fidler, F., & Cumming, G. (2018). Effect sizes and confidence intervals. In *The reviewer's guide to quantitative methods in the social sciences* (pp. 72–85). Routledge. https://books.google.it/books?hl=it&lr=&id=8zz3DwAAQBAJ&oi=fnd&pg=PA72&dq=fidler+%26+cumming+&ots=pOduN64S4I&sig=MrmWFpmIsUMVjbO8Ow0gTFC1Z3I

Francis, K. B., & McNabb, C. B. (2022). Moral Decision-Making During COVID-19: Moral Judgements, Moralisation, and Everyday Behaviour. *Frontiers in Psychology*, *12*. https://www.frontiersin.org/articles/10.3389/fpsyg.2021.769177

Garett, R., & Young, S. D. (2021). Online misinformation and vaccine hesitancy. *Translational Behavioral Medicine*, *11*(12), 2194–2199. https://doi.org/10.1093/tbm/ibab128

Garofalo, S., Giovagnoli, S., Orsoni, M., Starita, F., & Benassi, M. (2022). Interaction effect: Are you doing the right thing? *PLoS One*, *17*(7), e0271668.

Garrigan, B., Adlam, A. L. R., & Langdon, P. E. (2018). Moral decision-making and moral development: Toward an integrative framework. *Developmental Review*, *49*, 80–100. https://doi.org/10.1016/j.dr.2018.06.001

Gawronski, B., & Beer, J. S. (2016). What makes moral dilemma judgments "utilitarian" or "deontological"? *Social Neuroscience*, 1–7. https://doi.org/10.1080/17470919.2016.1248787

Gert, B., & Gert, J. (2002). *The Definition of Morality*. https://plato.stanford.edu/ENTRIES/morality-definition/

Gilbert, P. B., Montefiori, D. C., McDermott, A. B., Fong, Y., Benkeser, D., Deng, W., Zhou, H., Houchens, C. R., Martins, K., Jayashankar, L., Castellino, F., Flach, B., Lin, B. C., O'Connell, S., McDanal, C., Eaton, A., Sarzotti-Kelsoe, M., Lu, Y., Yu, C., UNITED STATES GOVERNMENT (USG)/COVPN BIOSTATISTICS TEAM. (2022). Immune correlates analysis of the mRNA-1273 COVID-19 vaccine efficacy clinical trial. *Science*, *375*(6576), 43–50. https://doi.org/10.1126/science.abm3425

Global excess deaths associated with COVID-19, January 2020—December 2021. (s.d.). Recuperato 22 settembre 2023, da https://www.who.int/data/stories/global-excess-deaths-associated-with-covid-19-january-2020-december-2021

Graham, J., Haidt, J., Koleva, S., Motyl, M., Iyer, R., Wojcik, S. P., & Ditto, P. H. (2013). Moral Foundations Theory. In *Advances in Experimental Social Psychology* (Vol. 47, pp. 55–130). Elsevier. https://doi.org/10.1016/B978-0-12-407236-7.00002-4

ISSN: 3035-062X
2025, 2(1)
Preliminary Reports and Negative Results in Life Science and Humanities

Graham, J., Nosek, B. A., Haidt, J., Iyer, R., Spassena, K., & Ditto, P. H. (2011). *Moral Foundations Questionnaire* [dataset]. https://doi.org/10.1037/t05651-000

Guidry, J. P. D., Laestadius, L. I., Vraga, E. K., Miller, C. A., Perrin, P. B., Burton, C. W., Ryan, M., Fuemmeler, B. F., & Carlyle, K. E. (2021). Willingness to get the COVID-19 vaccine with and without emergency use authorization. *American Journal of Infection Control*, *49*(2), 137–142. https://doi.org/10.1016/j.ajic.2020.11.018

Haidt, J., & Joseph, C. (2004). Intuitive ethics: How innately prepared intuitions generate culturally variable virtues. *Daedalus*, *133*(4), 55–66. https://doi.org/10.1162/0011526042365555

Hampton, K. (2014). *Social Media and the Spiral of Silence*.

Hornsey, M. J., Harris, E. A., & Fielding, K. S. (2018). The psychological roots of anti-vaccination attitudes: A 24-nation investigation. *Health Psychology*, *37*(4), 307–315. https://doi.org/10.1037/hea0000586

Huynh, H. P., & Senger, A. R. (2021). A little shot of humility: Intellectual humility predicts vaccination attitudes and intention to vaccinate against COVID-19. *Journal of Applied Social Psychology*, *51*(4), 449–460. https://doi.org/10.1111/jasp.12747

Kaewkrajang, P., Jatchavala, C., & Sangsuwan, T. (2023). Anxiety, Optimism, and COVID-19 Vaccine Hesitancy among Students in a University in Southern Thailand during the 2021 Academic Year. *Vaccines*, *11*(7), Articolo 7. https://doi.org/10.3390/vaccines11071157

Kahane, G. (2015). Sidetracked by trolleys: Why sacrificial moral dilemmas tell us little (or nothing) about utilitarian judgment. *Social Neuroscience*, *10*(5), 551–560. https://doi.org/10.1080/17470919.2015.1023400

Kahane, G., Everett, J. A. C., Earp, B. D., Farias, M., & Savulescu, J. (2015). 'Utilitarian' judgments in sacrificial moral dilemmas do not reflect impartial concern for the greater good. *Cognition*, *134*, 193–209. https://doi.org/10.1016/j.cognition.2014.10.005

Kata, A. (2010). A postmodern Pandora's box: Anti-vaccination misinformation on the Internet. *Vaccine*, *28*(7), 1709–1716. https://doi.org/10.1016/j.vaccine.2009.12.022

Kramer, M. D., Patrick, C. J., Krueger, R. F., & Gasperi, M. (2012). Delineating physiologic defensive reactivity in the domain of self-report: Phenotypic and etiologic structure of dispositional fear. *Psychological Medicine*, *42*(6), 1305–1320. https://doi.org/10.1017/S0033291711002194

Kricorian, K., Civen, R., & Equils, O. (2022). COVID-19 vaccine hesitancy: Misinformation and perceptions of vaccine safety. *Human Vaccines & Immunotherapeutics*, *18*(1), 1950504. https://doi.org/10.1080/21645515.2021.1950504

Lalot, F., Heering, M. S., Rullo, M., Travaglino, G. A., & Abrams, D. (2022). The dangers of distrustful complacency: Low concern and low political trust combine to undermine compliance with governmental restrictions in the emerging Covid-19 pandemic. *Group Processes & Intergroup Relations*, 25(1), 106-121.

Lamprinou, M., Sachinidis, A., Stamoula, E., Vavilis, T., & Papazisis, G. (2023). COVID-19 vaccines adverse events: Potential molecular mechanisms. *Immunologic Research*, *71*(3), 356–372. https://doi.org/10.1007/s12026-023-09357-5

Ledda, C., Costantino, C., Liberti, G., & Rapisarda, V. (2022). The Italian Version of the Adult Vaccine Hesitancy Scale (aVHS) for the Working-Age Population: Cross-Cultural Adaptation, Reliability, and Validity. *Vaccines*, *10*(2), 224. https://doi.org/10.3390/vaccines10020224

Lee, S. K., Sun, J., Jang, S., & Connelly, S. (2022). Misinformation of COVID-19 vaccines and vaccine hesitancy. *Scientific Reports*, *12*(1), 13681. https://doi.org/10.1038/s41598-022-17430-6

ISSN: 3035-062X
2025, 2(1)
Preliminary Reports and Negative Results in Life Science and Humanities

Limaye, R. J., Sauer, M., Ali, J., Bernstein, J., Wahl, B., Barnhill, A., & Labrique, A. (2020). Building trust while influencing online COVID-19 content in the social media world. *The Lancet Digital Health*, *2*(6), e277–e278. https://doi.org/10.1016/S2589-7500(20)30084-4

Loomba, S., de Figueiredo, A., Piatek, S. J., de Graaf, K., & Larson, H. J. (2021). Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. *Nature Human Behaviour*, *5*(3), Articolo 3. https://doi.org/10.1038/s41562-021-01056-1

Lotto, L., Manfrinati, A., & Sarlo, M. (2014). A New Set of Moral Dilemmas: Norms for Moral Acceptability, Decision Times, and Emotional Salience. *Journal of Behavioral Decision Making*, *27*(1), 57–65. https://doi.org/10.1002/bdm.1782

Lowry, R., & Peterson, M. (2012). Cost-benefit analysis and non-utilitarian ethics. *Politics, Philosophy & Economics*, *11*(3), 258–279. https://doi.org/10.1177/1470594X11416767

Lucifora, C., Martino, G., Curcuruto, A., Salehinejad, M. A., & Vicario, C. M. (2021). How Self-Control Predicts Moral Decision Making: An Exploratory Study on Healthy Participants. *International Journal of Environmental Research and Public Health*, *18*(7), Articolo 7. https://doi.org/10.3390/ijerph1807384

Luco, A. (2014). The Definition of Morality: Threading the Needle. *Social Theory and Practice*, *40*(3), 361–387.

Luyten, J., Bruyneel, L., & van Hoek, A. J. (2019). Assessing vaccine hesitancy in the UK population using a generalized vaccine hesitancy survey instrument. *Vaccine*, *37*(18), 2494–2501. https://doi.org/10.1016/j.vaccine.2019.03.041

MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, *33*(34), 4161–4164. https://doi.org/10.1016/j.vaccine.2015.04.036

Mason, H. E. (1996). *Moral Dilemmas and Moral Theory*. Oxford University Press.

McMahan, J. (A c. Di). (2013). Moral Intuition. In *The Blackwell Guide to Ethical Theory* (1ª ed., pp. 103–120). Wiley. https://doi.org/10.1111/b.9780631201199.1999.00007.x

McNeil, A., & Purdon, C. (2022). Anxiety disorders, COVID-19 fear, and vaccine hesitancy. *Journal of Anxiety Disorders*, *90*, 102598. https://doi.org/10.1016/j.janxdis.2022.102598

Mehling, W. E., Acree, M., Stewart, A., Silas, J., & Jones, A. (2018). The Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2). *PLOS ONE*, *13*(12), e0208034. https://doi.org/10.1371/journal.pone.0208034

Monteyne, P., & André, F. E. (2000). Is there a causal link between hepatitis B vaccination and multiple sclerosis? *Vaccine*, *18*(19), 1994–2001. https://doi.org/10.1016/S0264-410X(99)00533-2

Moscadelli, A., Albora, G., Biamonte, M. A., Giorgetti, D., Innocenzio, M., Paoli, S., Lorini, C., Bonanni, P., & Bonaccorsi, G. (2020). Fake News and Covid-19 in Italy: Results of a Quantitative Observational Study. *International Journal of Environmental Research and Public Health*, *17*(16), Articolo 16. https://doi.org/10.3390/ijerph17165850

Murphy, J., Vallières, F., Bentall, R. P., Shevlin, M., McBride, O., Hartman, T. K., McKay, R., Bennett, K., Mason, L., Gibson-Miller, J., Levita, L., Martinez, A. P., Stocks, T. V. A., Karatzias, T., & Hyland, P. (2021). Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nature Communications*, *12*(1), Articolo 1. https://doi.org/10.1038/s41467-020-20226-9

ISSN: 3035-062X
2025, 2(1)
Preliminary Reports and Negative Results in Life Science and Humanities

Nan, X., Wang, Y., Thier, K., Adebamowo, C., Quinn, S., & Ntiri, S. (2022). Moral Foundations Predict COVID-19 Vaccine Hesitancy: Evidence from a National Survey of Black Americans. *Journal of Health Communication*, *27*(11–12), 801–811. https://doi.org/10.1080/10810730.2022.2160526

Neely, S. R., Eldredge, C., Ersing, R., & Remington, C. (2022). Vaccine Hesitancy and Exposure to Misinformation: A Survey Analysis. *Journal of General Internal Medicine*, *37*(1), 179–187. https://doi.org/10.1007/s11606-021-07171-z

Nelder, J. A., & Wedderburn, R. W. M. (1972). Generalized Linear Models. *Journal of the Royal Statistical Society. Series A (General)*, *135*(3), 370–384. https://doi.org/10.2307/2344614

Neumann-Böhme, S., Varghese, N. E., Sabat, I., Barros, P. P., Brouwer, W., van Exel, J., Schreyögg, J., & Stargardt, T. (2020). Once we have it, will we use it? A European survey on willingness to be vaccinated against COVID-19. *The European Journal of Health Economics*, *21*(7), 977–982. https://doi.org/10.1007/s10198-020-01208-6

Ng, V. K. Y., & Cribbie, R. A. (2017). Using the Gamma Generalized Linear Model for Modeling Continuous, Skewed and Heteroscedastic Outcomes in Psychology. *Current Psychology*, *36*(2), 225–235. https://doi.org/10.1007/s12144-015-9404-0

Ng, V. K. Y., & Cribbie, R. A. (2019). The gamma generalized linear model, log transformation, and the robust Yuen-Welch test for analyzing group means with skewed and heteroscedastic data. *Communications in Statistics - Simulation and Computation*, *48*(8), 2269–2286. https://doi.org/10.1080/03610918.2018.1440301

Nichols, S., & Mallon, R. (2006). Moral dilemmas and moral rules. *Cognition*, *100*(3), 530–542. https://doi.org/10.1016/j.cognition.2005.07.005

Opel, D. J., Taylor, J. A., Mangione-Smith, R., Solomon, C., Zhao, C., Catz, S., & Martin, D. (2011). Validity and reliability of a survey to identify vaccine-hesitant parents. *Vaccine*, *29*(38), 6598–6605. https://doi.org/10.1016/j.vaccine.2011.06.115

Pagliaro S, Sacchi S, Pacilli MG, Brambilla M, Lionetti F, Bettache K, Bianchi M, Biella M, Bonnot V, Boza M, Butera F, Ceylan-Batur S, Chong K, Chopova T, Crimston CR, Álvarez B, Cuadrado I, Ellemers N, Formanowicz M, Graupmann V, Gkinopoulos T, Kyung Jeong EH, Jasinskaja-Lahti I, Jetten J, Muhib Bin K, Mao Y, McCoy C, Mehnaz F, Minescu A, Sirlopú D, Simić A, Travaglino G, Uskul AK, Zanetti C, Zinn A, Zubieta E. Trust predicts COVID-19 prescribed and discretionary behavioral intentions in 23 countries. PLoS One. 2021 Mar 10;16(3):e0248334. doi: 10.1371/journal.pone.0248334. PMID: 33690672; PMCID: PMC7946319.

Pizza, L., Ronfard, S., Coley, J. D., & Kelemen, D. (2023). Why we should care about moral foundations when preparing for the next pandemic: Insights from Canada, the UK and the US. *PloS One*, *18*(5), e0285549. https://doi.org/10.1371/journal.pone.0285549

Poland, G. A. (2011). MMR Vaccine and Autism: Vaccine Nihilism and Postmodern Science. *Mayo Clinic Proceedings*, *86*(9), 869–871. https://doi.org/10.4065/mcp.2011.0467

Prosser, A. M. B., Judge, M., Bolderdijk, J. W., Blackwood, L., & Kurz, T. (2020). 'Distancers' and 'non-distancers'? The potential social psychological impact of moralizing COVID-19 mitigating practices on sustained behaviour change. *British Journal of Social Psychology*, *59*(3), 653–662. https://doi.org/10.1111/bjso.12399

R Developement Core Team. (2023). *R: A language and environment for statistical computing* [Software]. https://cir.nii.ac.jp/crid/1370294721063650048

Revelle, W. (2023). *How to use the psych package for regression and mediation analysis*.

ISSN: 3035-062X
2025, 2(1)
Preliminary Reports and Negative Results in Life Science and Humanities

Roozenbeek, J., Schneider, C. R., Dryhurst, S., Kerr, J., Freeman, A. L. J., Recchia, G., van der Bles, A. M., & van der Linden, S. (2020). Susceptibility to misinformation about COVID-19 around the world. *Royal Society Open Science*, *7*(10), 201199. https://doi.org/10.1098/rsos.201199

Rosenfeld, D. L., & Tomiyama, A. J. (2022). Jab my arm, not my morality: Perceived moral reproach as a barrier to COVID-19 vaccine uptake. *Social Science & Medicine*, *294*, 114699. https://doi.org/10.1016/j.socscimed.2022.114699

Rossen, I., Hurlstone, M. J., Dunlop, P. D., & Lawrence, C. (2019). Accepters, fence sitters, or rejecters: Moral profiles of vaccination attitudes. *Social Science & Medicine*, *224*, 23–27. https://doi.org/10.1016/j.socscimed.2019.01.038

Sadoff, J., Gray, G., Vandebosch, A., Cárdenas, V., Shukarev, G., Grinsztejn, B., Goepfert, P. A., Truyers, C., Fennema, H., Spiessens, B., Offergeld, K., Scheper, G., Taylor, K. L., Robb, M. L., Treanor, J., Barouch, D. H., Stoddard, J., Ryser, M. F., Marovich, M. A., … Douoguih, M. (2021). Safety and Efficacy of Single-Dose Ad26.COV2.S Vaccine against Covid-19. *New England Journal of Medicine*, *384*(23), 2187–2201. https://doi.org/10.1056/NEJMoa2101544

Schmidtke, K. A., Kudrna, L., Noufaily, A., Stallard, N., Skrybant, M., Russell, S., & Clarke, A. (2022). Evaluating the relationship between moral values and vaccine hesitancy in Great Britain during the COVID-19 pandemic: A cross-sectional survey. *Social Science & Medicine*, *308*, 115218. https://doi.org/10.1016/j.socscimed.2022.115218

Sekizawa, Y., Hashimoto, S., Denda, K., Ochi, S., & So, M. (2022). Association between COVID-19 vaccine hesitancy and generalized trust, depression, generalized anxiety, and fear of COVID-19. *BMC Public Health*, *22*(1), 126. https://doi.org/10.1186/s12889-021-12479-w

Shapiro, G. K., Tatar, O., Dube, E., Amsel, R., Knauper, B., Naz, A., Perez, S., & Rosberger, Z. (2018). The vaccine hesitancy scale: Psychometric properties and validation. *Vaccine*, *36*(5), 660–667. https://doi.org/10.1016/j.vaccine.2017.12.043

Sinnott-Armstrong, W. P. (1983). *Moral Dilemmas.* https://elibrary.ru/item.asp?id=7362329

Spielberger, C. D. (1999). *Staxi-2: State-trait anger expression inventory-2; professional manual*. PAR, Psychological Assessment Resources.

The jamovi project-jamovi. ((Version 2.3)). (2023). [Software]. https://www.jamovi.org

Travaglino GA, Moon C. Compliance and Self-Reporting During the COVID-19 Pandemic: A Cross-Cultural Study of Trust and Self-Conscious Emotions in the United States, Italy, and South Korea. *Front Psychol.* 2021 Mar 16;12:565845. doi: 10.3389/fpsyg.2021.565845. PMID: 33796038; PMCID: PMC8007877.

Tsang, S., Royse, C. F., & Terkawi, A. S. (2017). Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. *Saudi Journal of Anaesthesia*, *11*(5), 80. https://doi.org/10.4103/sja.SJA_203_17

Turiel, E. (1983). *The Development of Social Knowledge: Morality and Convention*. Cambridge University Press.

Tustin, J. L., Crowcroft, N. S., Gesink, D., Johnson, I., & Keelan, J. (2018). Internet Exposure Associated With Canadian Parents' Perception of Risk on Childhood Immunization: Cross-Sectional Study. *JMIR Public Health and Surveillance*, *4*(1), e8921. https://doi.org/10.2196/publichealth.8921

Vicario, C. M., Kuran, K. A., Rogers, R., & Rafal, R. D. (2018). The effect of hunger and satiety in the judgment of ethical violations. *Brain and Cognition*, *125*, 32–36. https://doi.org/10.1016/j.bandc.2018.05.003

ISSN: 3035-062X
2025, 2(1)
Preliminary Reports and Negative Results in Life Science and Humanities

Vicario, C. M., Makris, S., Culicetto, L., Lucifora, C., Falzone, A., Martino, G., Ferraioli, F., Nitsche, M. A., Avenanti, A., & Craparo, G. (2023). Evidence of Altered Fear Extinction Learning in Individuals with High Vaccine Hesitancy During Covid-19 Pandemic. *Clinical Neuropsychiatry*, *20*(4), 364–369. https://doi.org/10.36131/cnfioritieditore20230417

Vicario, C. M., Mucciardi, M., Faraone, G., Lucifora, C., Schade, H. M., Falzone, A., Salehinejad, M. A., Craparo, G., & Nitsche, M. A. (2024). Individual predictors of vaccine hesitancy in the Italian post COVID-19 pandemic era. *Human Vaccines & Immunotherapeutics*, *20*(1), 2306677. https://doi.org/10.1080/21645515.2024.2306677

Vicario, C. M., Rafal, R. D., di Pellegrino, G., Lucifora, C., Salehinejad, M. A., Nitsche, M. A., & Avenanti, A. (2022). Indignation for moral violations suppresses the tongue motor cortex: Preliminary TMS evidence. *Social Cognitive and Affective Neuroscience*, *17*(1), 151–159. https://doi.org/10.1093/scan/nsaa036

Vicario, C. M., Rafal, R. D., Martino, D., & Avenanti, A. (2017). Core, social and moral disgust are bounded: A review on behavioral and neural bases of repugnance in clinical disorders. *Neuroscience and Biobehavioral Reviews*, *80*, 185–200. https://doi.org/10.1016/j.neubiorev.2017.05.008

Vicario CM, Lucifora C. (2021). Neuroethics: what the study of brain disorders can tell about moral behavior. *AIMS Neurosci.* 8(4):543-547. doi: 10.3934/Neuroscience.2021029.

Vicario, C.M. & Rafal, R.D. Relationship between body mass index and moral disapproval rating for ethical violations. *Personality and Individual Differences*, 104, 8-11

Wolfe, R. M., & Sharp, L. K. (2002). Anti-vaccinationists past and present. *BMJ*, *325*(7361), 430–432. https://doi.org/10.1136/bmj.325.7361.430

Wong, M. K., Brooks, D. J., Ikejezie, J., Gacic-Dobo, M., Dumolard, L., Nedelec, Y., Steulet, C., Kassamali, Z., Acma, A., Ajong, B. N., Adele, S., Allan, M., Cohen, H. A., Awofisayo-Okuyelu, A., Campbell, F., Cristea, V., De Barros, S., Edward, N. V., Waeber, A. R. E. C., … Van Kerkhove, M. D. (2023). COVID-19 Mortality and Progress Toward Vaccinating Older Adults—World Health Organization, Worldwide, 2020–2022. *Morbidity and Mortality Weekly Report*, *72*(5), 113–118. https://doi.org/10.15585/mmwr.mm7205a1

Zhou, A., Liu, W., Kim, H. M., Lee, E., Shin, J., Zhang, Y., Huang-Isherwood, K. M., Dong, C., & Yang, A. (2022). Moral Foundations, Ideological Divide, and Public Engagement with U.S. Government Agencies' COVID-19 Vaccine Communication on Social Media. *Mass Communication and Society*, 1–26. https://doi.org/10.1080/15205436.2022.2151919