



Implicit prejudices based on race and sexual orientation do not predict COVID-19 vaccine hesitancy in Italy during the post-pandemic era

Antony Casula^{1,2,°}, Simona Massimino^{1,*,°}, Giorgio Fichera¹, Riccardo Vitale¹, Chiara Lucifora³, Alessandra Falzone¹, Vanni Caruso⁴, Stergios Makris⁵, Carmelo Mario Vicario¹

¹Department of Cognitive Sciences, Psychology, Education and Cultural Studies, University of Messina, Messina (ME), Italy.

²School of Advanced Studies, Center for Neuroscience, University of Camerino, Camerino (MC), Italy.

³Department of Philosophy and Communication, University of Bologna, Bologna, Italy.

⁴School of Pharmacy and Pharmacology, University of Tasmania, Hobart, TAS 7005, Australia

⁵Department of Psychology, Edge Hill University, Ormskirk, Liverpool, UK.

[°]The authors equally contributed to the manuscript.

*Corresponding Author: simona.massimino@unime.it

Citation: Casula A., Massimino S., Fichera G., Vitale R., Lucifora C., Falzone A., Caruso V., Makris S., Vicario C.M. (2024). Implicit prejudices based on race and sexual orientation do not predict COVID-19 vaccine hesitancy in Italy during the post-pandemic era. *Preliminary Reports and Negative Results in Life Science and Humanities* 1(1). <https://doi.org/10.13129/XXXX-YYYY/PRNR-ZZZZ>

Abstract

Background. COVID-19 has led to over 14 million deaths worldwide, evidencing the importance of investigating its antecedents. However, despite the increasing research efforts, the psychological underpinnings of vaccine rejection and vaccine hesitancy have not yet been completely understood. Previous literature showed in large samples that vaccine rejection is associated with explicit prejudice towards immigrants in UK and Ireland (Murphy et al., 2021).

Aims. Building upon the existing literature and recognizing a research gap, our research aims to delve into the intricate nexus of factors contributing to vaccine hesitancy. Specifically, we investigate the role of social behavior by focusing on implicit prejudices concerning Race and Sexual Orientation.

Method. The present study involved the administration of two Implicit Association Tests (IATs), focusing on Race and Sexual Orientation, and VH score. A regression (employing generalized linear models) with the IAT score as predictor and VH score as predicted for each IAT, and two independent samples T-test for comparing race IAT and sexual orientation IAT scores in participants with high- vs low VH.

Results. Results showed that vaccine hesitancy and vaccine rejection are not related to implicit prejudice for either race and sexual orientation in our sample of young Italian students in the post-pandemic era.

Keywords: Vaccine Hesitancy, COVID-19, Prejudice, Implicit Association Test, Race prejudice, Sexual prejudice.

Introduction

The emergence of the severe acute respiratory syndrome coronavirus 2 (Sars-CoV-2) has led to a worldwide public health crisis, resulting in 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).

Multiple vaccines have been developed for COVID-19 prevention, highlighting the importance of effective governmental action in addressing this significant global challenge (Neumann-Böhme et al., 2020).



Despite the demonstrated benefits of COVID-19 vaccines in reducing infection rates, hospitalizations, and fatalities with minimal safety concerns (Christie et al., 2021; Gilbert et al., 2022; Lamprinou et al., 2023; Sadoff et al., 2021), approximately 25% of the global population exhibit vaccine hesitancy (VH) or resistance (Guidry et al., 2021; Kricorian et al., 2022; Murphy et al., 2021; Neumann-Böhme et al., 2020), posing a significant risk to pandemic response efforts. A report published in 2019 by the World Health Organization (WHO) emphasizes the critical nature of addressing vaccine hesitancy and resistance as one of the top public health concerns (*Ten Health Issues WHO Will Tackle This Year*, 2019). VH encompasses a spectrum of attitudes ranging from doubtful acceptance to outright refusal of vaccines (Dubé et al., 2013; MacDonald, 2015), and is deeply embedded within the fabric of society and its complex dynamics (Murphy et al., 2021; Streefland et al., 1999). Understanding the historical, political, and socio-cultural context is crucial in vaccination planning, while examining the psychological factors associated with VH could provide insights into the underlying causes of this socially significant phenomenon, facilitating the development of effective communication strategies and safety measures. In this regard, antivaccination attitudes have been associated with higher conspiratorial thinking, reactance tendencies (resistance to loss of freedom), levels of disgust toward blood and needles, individualistic or hierarchical worldviews, overt rejection of scientific knowledge and distrust of experience, and explicit prejudice towards immigrants (Hornsey et al., 2018; Kata, 2010; Murphy et al., 2021). In this work we focused on psychosocial correlates of VH, with higher regard for social prejudice.

Social prejudice, often referred to simply as prejudice, pertains to biased attitudes, beliefs, or opinions held against individuals or groups based on certain characteristics, such as race, ethnicity, gender, or sexual orientation (Allport et al., 1954).

In the early 20th century, explicit expressions of prejudice were common in Western societies (Devine, 1989; Pettigrew & Meertens, 1995). However, as social norms shifted toward greater egalitarianism, prejudice has evolved to operate covertly, adopting implicit and unconscious forms that are difficult to detect and address (Amodio, 2014; Devine, 1989; McConahay, 1986; Pettigrew & Meertens, 1995). Consequently, research has developed implicit measures of prejudice, with the Implicit Association Test (IAT) (Greenwald et al., 1998) being one of the most reliable. Social cognition plays a fundamental role in how individuals process information, make decisions, and form attitudes within social contexts, thereby influencing attitudes toward vaccines (Dubé et al., 2013; Hagger & Hamilton, 2022).

Empirical evidence for the association between COVID-19 vaccine rejection and explicit attitudes towards minorities (e.g., migrants) was provided by Murphy et al. (Murphy et al., 2021), showing that vaccine resistant individuals were more openly intolerant towards migrants, and more tendent to political conservatism (Murphy et al., 2021). This association could easily be explained by political orientation: it is known that political conservative wings openly opposed to vaccination and alimented the anti-vax movements during the COVID-19 pandemics in most countries (Bilewicz & Soral, 2022; Howard, 2022). Nevertheless, the association between political orientation and VH is not ubiquitous, and it variates across countries, strongly depending on cultural factors (Stoeckel et al., 2022).

Despite the documented link between Vaccine Hesitancy (VH) and explicit social prejudice (Murphy et al., 2021), there exists a notable research gap regarding implicit social prejudice assessed through a validated and reliable instrument. Addressing this gap is crucial for expanding our



understanding of the intricate relationship between prejudice and VH, which may go undetected in various samples due to individuals concealing their prejudice for both internal (internalized nonprejudiced beliefs) and external reasons (Devine, 1989; Plant & Devine, 1998).

Drawing from the existing literature and acknowledging this research gap, our study aims to explore the connection between implicit prejudice toward black individuals and homosexual individuals. This investigation will utilize two Implicit Association Tests (IATs) focusing on race and sexual orientation, respectively, to examine their association with Vaccine Hesitancy (VH) specific to COVID-19 and proness to COVID-19 vaccination.

This study aimed to investigate the relationship between VH of the COVID-19 vaccine and implicit prejudice towards black and homosexual individuals. Also, correlations with other psychological variables were explored for further investigations.

Since COVID-19 vaccine hesitancy has been positively correlated to explicit prejudice toward migrants (Murphy et al., 2021), we hypothesize that (i) individuals with high VH will exhibit higher implicit prejudice toward social minorities, i.e., homosexual people (higher IAT_Sex score) compared to low VH ones; (ii) individuals with high VH will exhibit higher implicit prejudice toward black people (higher IAT_Race score) compared to low VH ones. For the same reason (iii) no-vax individuals will exhibit higher implicit prejudice toward social minorities, i.e., homosexual people (higher IAT_Sex score) compared to “si-vax” (pro-vax) individuals; (iiii) no-vax individuals will exhibit higher implicit prejudice toward black people (higher IAT_Race score) compared to si-vax individuals. (iiiii) implicit prejudice toward black individuals will predict higher VH toward COVID-19 vaccines; (iiiii) implicit prejudice toward homosexual individuals will predict higher VH toward COVID-19 vaccines.

Vaccine hesitancy and implicit prejudice

1. Materials and Methods

1.1 Participants

The sample consisted of 104 young and healthy volunteers of Italian nationality, aged between 18 and 36 years, with a mean age (M_{Age}) of 23.16 years and a standard deviation (SD_{age}) of 4.38; (Females: $N=55$, $M_{Age}=22.07 \pm 3.97$; Males: $N=49$, $M_{Age}=24.38 \pm 4.52$).

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 University of Messina and complied with the ethical standards of the 1964 Declaration of Helsinki.

1.2 Measures

The research protocol required volunteers to fill in an anamnestic survey (age and gender), a series of questionnaires, and two different versions of the Implicit Association Test (Greenwald et al., 2003).

The following questionnaires and scales were used:



The *adult Vaccine Hesitancy Scale for Covid-19* (aVHS), a vaccine hesitancy scale for adults (Rodriguez et al., 2022), composed of 2 sections: VHSa is an adaptation of the VHS by Shapiro et al. (Shapiro et al., 2018) with the last item changed to include COVID-19 as follows “I do not need vaccines for Coronavirus as it will disappear soon”, and VHSb includes a series of 7 dicotomic questions about the hypothetical intention to vaccinate against COVID-19. The VHSb score was calculated as the total number of “no” responses, yielding an 8-point (range: 0-7) variable. In addition, the response to the first item of VHSb (“If a vaccine to prevent COVID-19 infection was available would you get vaccinated?”) was collected separately for categorizing participants based on their vaccination uptake availability in “si-vax” and “no-vax” individuals. The original scale showed acceptable reliability (Cronbach’s $\alpha = 0.72$) (Rodriguez et al., 2022).

The *Six-item Misinformation Scale about COVID-19*, developed by Roozenbeek et al. (Roozenbeek et al., 2020), assesses susceptibility to misinformation regarding COVID-19. It includes nine statements about the virus, with six representing common instances of health-related and political misinformation. Additionally, two statements convey factual information, while one statement is ambiguous. The scale demonstrated good reliability for misinformation items, with Cronbach’s $\alpha = 0.83$, but not for factual and ambiguous items, with Cronbach’s $\alpha = 0.35$ (Roozenbeek et al., 2020).

The *Multidimensional Assessment of Interoceptive Awareness – Version 2 (MAIA-2)* (Mehling et al., 2018), is a self-report questionnaire that measures multiple dimensions of interoception (awareness of bodily sensations). It comprises 37 items grouped into 8 scales. The Italian version of the scale (Calì et al., 2015), employed in this study, demonstrated satisfactory internal consistency, with Cronbach’s α ranging between 0.53 and 0.80.

The *Social and Economic Conservatism Scale (SECS)* (Everett, 2013) measures support for “peripheral” aspects of conservatism using 12 items. Reliability analyses indicated good internal consistency, with Cronbach’s $\alpha = 0.88$ for the complete scale, Cronbach’s $\alpha = 0.70$ for the economic conservatism subscale, and Cronbach’s $\alpha = 0.87$ for the social conservatism subscale (Everett, 2013).

The *Trait Fear-55 (TF-55)* (Kramer et al., 2012) is a questionnaire consisting of 55 items designed to measure fear as a personality trait. The scale exhibits excellent internal consistency (Cronbach’s $\alpha = .96$) (Kramer et al., 2012).

A single-item 7-point Likert Political Orientation scale was used to assess participants' political orientation (“What is your political orientation?”), with responses ranging from 1 (extreme left) to 7 (extreme right). Participants also were allowed to respond with “I do not know/I do not want to respond.”.

We performed the forward-back translation (Bontempo, 1993; Tsang et al., 2017) in conjunction with a second study performed by our research group. The process involved the SECS (Everett, 2013), the *Misinformation Scale about COVID-19* (Roozenbeek et al., 2020), the TF-55 (Kramer et al., 2012) and the Vaccine Hesitancy Scale for COVID-19 (Rodriguez et al., 2022), whereas for the other questionnaires, validated Italian versions were available. In the initial phase, three separate forward translations were generated by Italian native-speakers proficient in English. These translators (two of which are authors: G.F. and R.V., and a third is author in the second study), with backgrounds 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 translator, proficient in Italian, and 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 from the Laboratory of Social and Cognitive Neuroscience of the University of Messina. The materials of the translation process were uploaded in the file “forward-back translation” in the OSF online repository.

IAT

The *Implicit Association Test* (IAT) is a valid and reliable test (Cronbach's $\alpha = 0.70-0.90$) (Nosek et al., 2006) used to measure the implicit associations between different concepts, such as racial prejudice, gender stereotypes, or other conceptual relationships (Greenwald et al., 2003). This test measures responses to two sets of stimuli by associating them with “positive” and “negative” concepts. Participants quickly categorize stimuli displayed on a screen using two keys, one on the left (associated with the left category) and one on the right (associated with the right category) (Greenwald et al., 1998). We employed two different IATs concerning race and sexual orientation, respectively:

- *Sex IAT* consists of a version of the IAT with target words associated with sexual orientation and positive and negative words. The classes used for categorization were “heterosexual” and “homosexual,” along with the words “positive” and “negative”;
- *Race IAT* consists of a version of the IAT with target words associated with race and positive and negative words (good and bad). The classes used for categorization were “white” and “black,” along with the words “positive” and “negative”.

2.2 Data Collection

Following welcoming, volunteers signed informed consent and were also informed of their right to privacy, non-recognition, and anonymity. Subsequently, the participants were seated in front of a computer to perform the IATs and questionnaires in a randomized and counterbalanced order. Most of the questionnaires were administered using E-Prime 3.0 software (Psychology Software Tools, Pittsburgh, PA) in randomized order. Two questionnaires were administered using Microsoft Excel, in counterbalanced order. All items of the questionnaires were also presented in randomized order. The IAT was generated using the IAT Gen website (<https://iatgen.wordpress.com/>) (Carpenter et al., 2023) for administration on the Qualtrics online platform (<https://www.qualtrics.com/it/>). The general Excel - IATs - E-prime order was counterbalanced, with the IATs always in the central block. All raw and scored data were uploaded in the OSF online repository (<https://doi.org/10.17605/OSF.IO/C8AQJ>).

2.3 Data Analysis

Significance was set at $p < 0.05$. All analyses were conducted using the statistical software R (R Development Core Team, 2023) with the Psych package (Revelle, 2023) and the statistical software Jamovi (*The jamovi project-jamovi.*, 2023).



Firstly, following the procedure employed by Greenwald and colleagues (Greenwald et al., 2003) for the analysis of IAT data, the IAT score was automatically calculated by the IAT Gen website. The scores obtained indicate implicit prejudice toward homosexual/black individuals, with higher scores associated with more prominent implicit prejudice (Greenwald et al., 2003).

To assess explore normal distribution of the residuals, Shapiro-Wilk tests over the whole dataset were computed. Since most variables showed a non-Gaussian distribution, we performed Spearman correlations on the whole dataset and a series of tests employing the Generalized Linear Model. For normally distributed variables we employed parametric tests (i.e., independent samples t-tests). For the correlation tests, outliers (i.e., values above +/- 1.5 IQR from the 25th and 75th percentiles as computed by the function “boxplot()” in R) were removed. The “Hesitancy Quart” dichotomic variable was created by selecting the extreme quartiles of the VHSa distribution and ignoring the central 50% of the distribution.

Four independent samples t-tests were computed: The model 1a involved the dichotomic variable “Hesitancy_Quart” as a factor and IAT_Sex score as dependent variable, and Model 1b involved the dichotomic variable “Hesitancy_Quart” as a factor and IAT_Race score as dependent variable.

Model 2a involved the dichotomic variable “Vaccine_intention” as a factor and IAT_Sex score as dependent variable, and the Model 2b involved the dichotomic variable “Vaccine_intention” as a factor and IAT_Race score as dependent variable.

Two GzLM tests were computed assuming a gamma distribution (which fits with right-skewed and potentially heteroschedastic distributions) and a logarithmic link function (Nelder & Wedderburn, 1972; Ng & Cribbie, 2017, 2019): Model 3a involved IAT_Sex score as a predictor, and VHSa as criterion, while Model 3b involved IAT_Race as a predictor, and VHSa as criterion.

2. Results

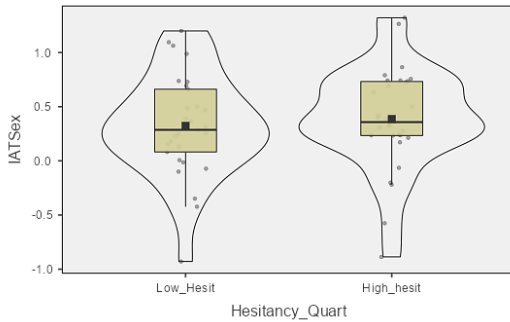
Descriptive statistics and frequency tables are provided in the “complete analyses” file uploaded on the OSF website.

Spearman correlations computed with Bonferroni corrections for multiple comparisons yielded one statistically significant correlation (except for correlations between subscales of the same questionnaire). VHSa positively correlated with Misinformation about COVID-19 ($r = .472, p < .001$). The full Correlation matrix is provided in the “complete analyses” file uploaded in OSF website.

Since both IAT scores were normally distributed, we computed four independent samples t-tests. Models 1a and 1b did not reveal statistically significant differences between High and Low Hesitancy individuals for IAT_Sex [$t(57) = -0.513, p = .610, \text{Cohen's } d = -0.134$] and IAT_Race [$t(56) = 0.074, p = .941, \text{Cohen's } d = -0.019$] scores. The Box and Violin plots for the t-tests are presented in Figure 8.



A) IAT-sex



B) IAT-race

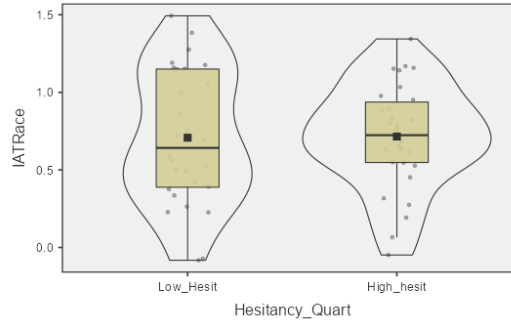
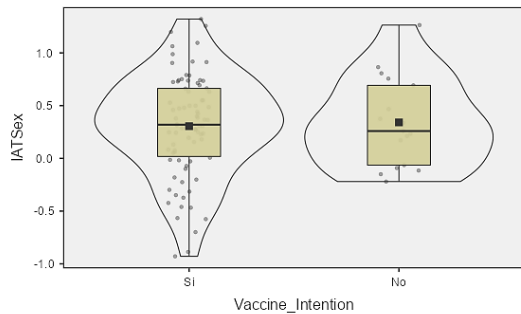


Figure 8. Box and violin plots computed on the independent sample T-tests for the difference between high (higher quartile) and low (lower quartile) hesitancy individuals in A) IAT-sex and B) IAT-race scores. Hesitancy_Quart consists of extreme quartiles of vaccine hesitancy scale’s (VHS) distribution. The squares represent means, and the black lines medians. The boxes represent the interval between 25th and 75th percentiles.

Models 2a and 2b did not reveal statistically significant differences between COVID-19 vaccine “si-vax” and “no-vax” individuals for IAT_Sex [$t(97) = -0.283, p = .777, \text{Cohen's } d = -0.076$] and IAT_Race [$t(97) = 0.163, p = .871, \text{Cohen's } d = 0.044$] scores. The Box and Violin plots for the t-tests are presented in Figure 9.

A) IAT-sex



B) IAT-race

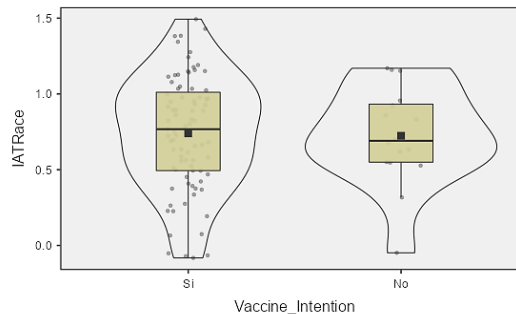


Figure 9. Box and violin plots computed on the independent sample T-tests for the difference between COVID-19 pro-vax and no-vax individuals in A) IAT-sex and B) IAT-race scores. “Vaccine_Intention” captures the availability for vaccination, dividing the distribution in pro-vax and no-vax individuals. The squares represent means, and the black lines medians. The boxes represent the interval between 25th and 75th percentiles.

The two GzLM tests did not evidence statistically significant effects of IAT_Sex [$X^2(1)=0.000$, $p = .990$] and IAT_Race [$X^2(1)=0.182$, $p = .670$] on VHSa. The Scatterplots with fitted lines of the two models are shown in Figure 10.

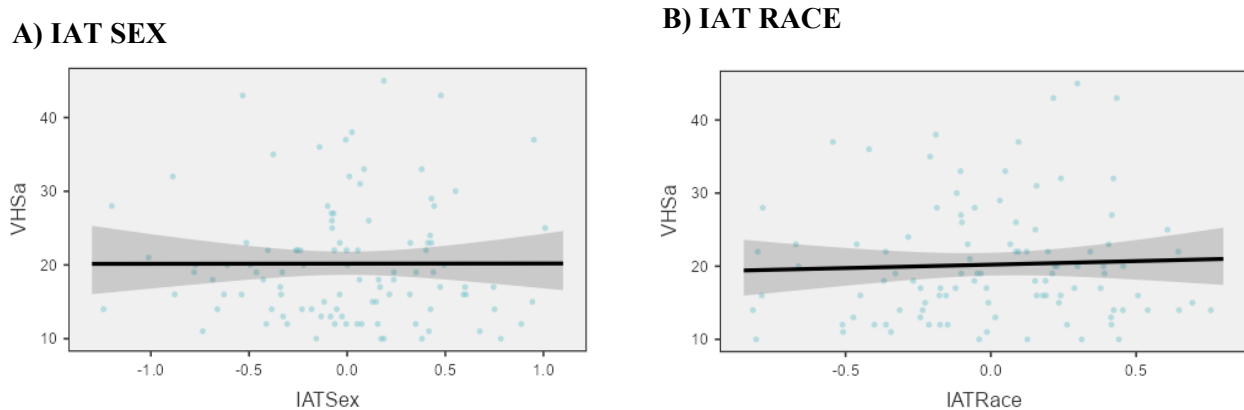


Figure 10. Regression slopes for the Models 2a (A) and 2b (B). 95% CI are evidenced in grey.

The complete analyses were uploaded to the OSF online repository (<https://doi.org/10.17605/OSF.IO/C8AQJ>).

3. Discussion and limitations

The results obtained by Murphy and collaborators (Murphy et al., 2021) showed a higher explicit prejudice toward immigrants for hesitant individuals for COVID-19 vaccines than for lower explicit prejudice ones in United Kingdom and Ireland. In the present study we investigated whether this difference is present also at the implicit level, providing participants with two versions of the IAT. In the first version, they were called to respond to words related to sex prejudice (prejudice toward homosexual individuals; IAT-sex), whereas in the second one, they responded to words related to ethnic prejudice (IAT-race). The results of Murphy et al. (2021) were not confirmed in our study. The results obtained in the present research do not provide evidence for a difference in implicit prejudice toward homosexual (hypothesis i) and black (hypothesis ii) individuals between participants with high vs low COVID-19 VH. The findings remain consistent across both pro-vaccine (si-vax) and anti-vaccine (no-vax) individuals, indicating no significant disparity in implicit prejudice towards homosexual individuals (hypothesis iii) and black individuals (hypothesis iiiii). Additionally, we did not find any effect of IAT scores on VH scores (hypotheses iiiiii and iiiiii). This indicates that COVID-19 vaccine hesitancy does not appear to be predicted by implicit biases toward minorities.

This result could be due to several reasons: firstly, we employed implicit measures of prejudice towards black and homosexual individuals, while Murphy and colleagues employed an explicit self-report measure of attitudes toward migrants. Implicit and explicit measures often show low-to-absent correlations, and we cannot assert without doubts that they measure the same processes and attitudes (Hofmann et al., 2005; Van Dessel et al., 2020). Furthermore, while we conducted the study during the WHO declaration of a concluded emergency state (between March and June 2023), Murphy's study was conducted during the height of the COVID-19 emergency, and before the development of the COVID-19 vaccines.



Additionally, our sample was mostly composed of young Italian students, whereas Murphy and colleagues explored representative samples of the UK and Ireland populations, with a wider age range (Murphy et al., 2021). Moreover, in the study of Murphy et al. (2021) online survey was employed, while we collected data in person at the laboratory of Social and Cognitive Neuroscience, University of Messina, Italy. All the listed factors could partially explain the observed inconsistencies and aid us to better understand the psychosocial correlates of vaccine hesitancy and vaccine decision.

Author Contributions

C.M. Vicario contributed to the conception and design of the studies. A. Casula, G. Fichera, and R. Vitale were responsible for data collection. A. Casula, and S. Makris were responsible for assistance in data collection. A. Casula was responsible for data management and statistical analysis. A. Casula and S. Massimino were responsible for the drafting and finalization of the manuscript. All authors contributed to the manuscript revision and approved the submitted version.

Funding

CMV was supported by Ministero Istruzione Università e Ricerca (PRIN 2022, NextGenerationEU. Project code: 2022L3AALJ).

Informed Consent Statement

The studies were approved by the independent ethics committee (Approval n. COSPECS_07_2022) of the Department of Sciences, Psychology, Education and Cultural Studies, University of Messina. The participants provided their written informed consent to participate in the study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Data Availability Statement

All the data not available in the manuscript have been uploaded to the Open Science Framework online repository in accordance with open science principles: <https://doi.org/10.17605/OSF.IO/C8AQJ>.

Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

- Allport, G. W., Clark, K., & Pettigrew, T. (1954). *The nature of prejudice*. http://althaschool.org/_cache/files/7/1/71f96bdb-d4c3-4514-bae2-9bf809ba9edc/97F5FE75CF9A120E7DC108EB1B0FF5EC.holocaust-the-nature-of-prejudice.doc
- Amodio, D. M. (2014). The neuroscience of prejudice and stereotyping. *Nature Reviews Neuroscience*, *15*(10), 670–682. <https://doi.org/10.1038/nrn3800>
- 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>
- Cali, 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>
- Carpenter, T., Pogacar, R., Pullig, C., Kouril, M., Aguilar, S. J., LaBouff, J. P., Isenberg, N., & Chakroff, A. (2023). *Survey-Software Implicit Association Tests: A Methodological and Empirical Analysis*. <https://doi.org/10.31234/osf.io/hgy3z>
- Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, *56*(1), 5–18. <https://doi.org/10.1037/0022-3514.56.1.5>



- 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>
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464–1480. <https://doi.org/10.1037/0022-3514.74.6.1464>
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197–216. <https://doi.org/10.1037/0022-3514.85.2.197>
- Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A Meta-Analysis on the Correlation Between the Implicit Association Test and Explicit Self-Report Measures. *Personality and Social Psychology Bulletin*, 31(10), 1369–1385. <https://doi.org/10.1177/0146167205275613>
- 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>
- 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>
- McConahay, J. B. (1986). Modern racism, ambivalence, and the Modern Racism Scale. In *Prejudice, discrimination, and racism* (pp. 91–125). Academic Press.
- 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>
- 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>
- 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>
- 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>
- Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2006). *The Implicit Association Test at Age 7: A Methodological and Conceptual Review*.
- Pettigrew, T., & Meertens, R. (1995). Subtle and Blatant Prejudice in Western Europe. *European Journal of Social Psychology*, 25, 57–75. <https://doi.org/10.1002/ejsp.2420250106>
- R Development 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*.



- Rodriguez, V. J., Alcaide, M. L., Salazar, A. S., Montgomerie, E. K., Maddalon, M. J., & Jones, D. L. (2022). Psychometric Properties of a Vaccine Hesitancy Scale Adapted for COVID-19 Vaccination Among People with HIV. *AIDS and Behavior*, 26(1), 96–101. <https://doi.org/10.1007/s10461-021-03350-5>
- 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>
- 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>
- Streefland, P., Chowdhury, A. M. R., & Ramos-Jimenez, P. (1999). Patterns of vaccination acceptance. *Social Science & Medicine*, 49(12), 1705–1716. [https://doi.org/10.1016/S0277-9536\(99\)00239-7](https://doi.org/10.1016/S0277-9536(99)00239-7)
- Ten health issues WHO will tackle this year.* (2019). <https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019>
- The jamovi project-jamovi.* ((Version 2.3)). (2023). [Software]. <https://www.jamovi.org>
- Van Dessel, P., Cummins, J., Hughes, S., Kasran, S., Cathelyn, F., & Moran, T. (2020). Reflecting on 25 Years of Research Using Implicit Measures: Recommendations for Their Future Use. *Social Cognition*, 38(Supplement), s223–s242. <https://doi.org/10.1521/soco.2020.38.suppl.s223>
- 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>

