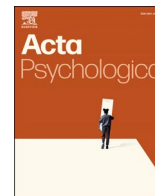




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Fear trumps the common good: Psychological antecedents of vaccination attitudes and behaviour[☆]

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ABSTRACT

The study investigated antecedents of attitudes towards vaccines against COVID-19 and vaccination behaviour, and sought to identify areas where interventions aimed at increasing vaccination rates would be most effective. A sample of 500 Slovaks (250 women) responded to questions concerning their socio-demographic and personality characteristics, collectivism and individualism, consciousness of future consequences, and emotional responses to both vaccination and the pandemic. The study indicates that helplessness related to the vaccine efficacy evaluation and fear of its potential risks are the strongest antecedents of vaccination behaviour and anti-vaccination attitudes. Jointly with the fear of the COVID-19, they explained over 26% and 33% of variance in behaviour and attitudes, respectively. The results indicate that the efficiency of appeals to solidarity may be limited when fear and helplessness are widespread as they seem to strongly outweigh individuals' outward motivations to get vaccinated.

1. Introduction

Since the COVID-19 outbreak, research teams around the world have joined efforts to develop vaccines that could become a more efficient measure in combating the pandemic than social distancing and lockdowns. However, vaccination efficiency depends heavily on the number of people vaccinated in the population. Unfortunately, even before vaccines were available, it had become clear that a considerable proportion of people would oppose inoculation. With the spread of the delta and then omicron variants the percentage of people needed to be vaccinated to achieve herd immunity became significantly higher. This highlighted the urgency to understand factors underlying vaccination attitudes and behaviour (understood as the actual uptake of the vaccines, readiness to be vaccinated against COVID-19 and persuading others of the benefits of vaccines). Thus, the present study aimed to investigate the explanatory role of sociodemographic characteristics, personality, collectivism and individualism, consideration of future consequences, and feelings of threat and helplessness as factors underlying vaccination attitudes and behaviour.

The paper's contribution to the literature and to practice is threefold.

Primarily, the current study is among the first that explains not only attitudes regarding COVID-19 vaccination but also actual behaviour in the context of individuals' outward orientation, including collectivism and consideration of future consequences. Second, unlike most previous studies, we did not focus on a specific subgroup of predictors. Instead, the study included a series of factors identified in the extant literature as antecedents of vaccination attitudes and behaviour. Consequently, the most important contribution of the present study rests in establishing the relative weights of sociodemographic characteristics, personality, collectivism and individualism, consideration of future consequences, and feelings of threat and helplessness in explaining individual differences in vaccination attitudes and behaviour. Importantly, the results indicate that an explanation for low vaccination rates should be sought not in the lack of individuals' prosocial or outward orientation but rather in their inflated sense of threat and helplessness. Finally, the result could inform interventions necessary to increase vaccination rates among particularly hesitant individuals or communities that are still far from achieving herd immunity.

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1.1. Vaccination as a prosocial behaviour

Vaccination, as it protects not only inoculated persons but also those around them, is a form of social contract in which vaccination follows a moral obligation to protect the vulnerable (Korn et al., 2020). Indeed, Karlsson et al. (2021) found that the perceived risk of COVID-19 to the respondents' own health did not predict vaccination intentions. Instead, a more important factor was how threatening they considered the disease to be to others.

Previous have studies provided considerable support for the hypothesis that collectivistic orientation positively relates to considerations for the others' needs through fostering solidarity and prosociality oriented towards own in-groups (Barrett et al., 2004; Booysen et al., 2021). In the context of vaccines against COVID-19, individuals holding more collectivistic values also reported stronger vaccination intentions (Burke et al., 2021). It seems that collectivists may perceive containing the pandemic as a public good. Thus, even if they do not feel particularly threatened themselves, collectivists may be inclined to contribute to it by accepting vaccination. Therefore, we could expect collectivism to be positively related to vaccination behaviour (H1a) and negatively to anti-vaccination attitudes (H1b).

Future orientation reflects an individual's consideration of the future consequences of current behaviour and, specifically, the willingness to sacrifice immediate benefits for the sake of future gains. Being future-oriented, thus, could positively affect individuals' vaccination attitudes and behaviour by increasing awareness of future outcomes and the potential loss and regret related to present decisions and negligence (Strathman et al., 1994). Importantly, consideration of future consequences turned out to predict parents' willingness to vaccinate their children against cervical cancer (Morison et al., 2010). In the context of the COVID-19 pandemic, Lalot et al. (2021) expected future orientation to promote adherence to presently restrictive containment measures with the view of achieving common goals in the future. Consequently, even in the absence of collectivistic attitudes, future-oriented individuals could actively seek to promote social goals, particularly through vaccination. In other words, we could expect future orientation to be positively related to vaccination behaviour (H2a) and negatively to anti-vaccination attitudes (H2b).

1.2. The role of demographics and personality traits in attitudes to vaccination

Several studies found that being female, higher age, and lower education and income are related to vaccine hesitancy (Lee et al., 2017). Following those results, we could expect being female, being of higher age, and having lower education and income to be positively related to vaccination behaviour (H3a) and negatively to anti-vaccination attitudes (H3b). Previous research also indicates a relationship between personality traits and attitudes towards vaccination. The most common method for assessing personality traits is Big Five measuring of five broad traits: Extraversion (characterised by the facets sociability, assertiveness, and energy level), Agreeableness (characterised by the facets compassion, respectfulness, and trust), Conscientiousness (characterised by the facets organisation, productiveness, and responsibility), Neuroticism – in newer versions replaced by Negative Emotionality – (characterised by the facets anxiety, depression, and emotional volatility), and lastly Openness (characterised by the facets curiosity, aesthetic sensitivity, and creative imagination) (Halama et al., 2020). Specifically, people scoring high in Agreeableness, Conscientiousness and Emotional Stability expressed greater vaccine confidence and saw vaccination as beneficial. Moreover, it seems that attitudes regarding vaccination are negatively associated with openness (e.g., Lee et al., 2017). We therefore hypothesised that high conscientiousness and agreeableness, and low openness to be positively related to vaccination behaviour (H4a) and negatively to anti-vaccination attitudes (H4b).

1.3. Emotional responses to the disease and vaccine threats

Finally, previous research identified several emotional factors that could affect people's intention to get vaccinated. Generally, the willingness to accept a vaccine increases with worries concerning contracting the disease or the severity of its symptoms (e.g., Betsch et al., 2018). Studies conducted in the U.S. and Germany indeed found that subjectively perceived threats posed by COVID-19 were associated with greater intention to vaccinate (Malik et al., 2020). However, Karlsson et al. (2021) observed that vaccine safety concerns might outweigh the fear of contracting the disease. Consequently, we could expect the vaccine threat to be negatively related (H5a) and COVID-19 threat to be positively related to vaccination behaviour (H5b). In analogy to previous relations, we also expect reversed relations of COVID-19 and vaccine threats with anti-vaccination attitudes (H6a and H6b).

Furthermore, because vaccines against COVID-19 were developed relatively fast, people may fear that in the trade-off between speed and safety, safety was sacrificed. Indeed, when people perceive a vaccine as unsafe and its completion as rushed, their willingness to get vaccinated drops (Pogue et al., 2020). The seemingly hasty pace of vaccine development and the lack of either reliable information or understanding of the scientific process that led to it leave people feeling helpless in evaluating possible side effects of the vaccines. Consequently, helplessness was expected to be negatively related to vaccination behaviour (H7a) and positively to anti-vaccination attitudes (H7b).

2. Methods

2.1. Participants and procedure

In total, 715 respondents started the survey, but 215 did not complete the whole questionnaire or did not pass the attention-check questions. Therefore, the final sample consisted of 500 participants (250 men, 250 women) aged 18–86 years ($M = 44.32$, $SD = 15.66$) recruited by an external agency to be representative of the Slovak population with regard to age and gender. Participants gave written consent to participate in the study by confirming that they are over 18, have read all the information about the study prior to participating and agreeing to participate. In terms of achieved education, 13.4% of the sample had elementary or an incomplete high school education, 46.2% had a complete high school education, and 40.4% had some university or a complete university education.

All methods were carried out in accordance with standards of the American Psychological Association¹ and were approved by the Ethical Board of the Masaryk University as a part of the MSCA-IF grant (MSCAfellow3@MUNI). Descriptive statistics for all measured variables are in Table 1. All materials and raw data are available at:

<https://osf.io/pfr7d/>.

The study was run between 24 May 2021 and 2 June 2021, when vaccines were already available, yet scarce (only elderly and people on the front lines were eligible to receive vaccination). The survey took the form of an online questionnaire created in Qualtrics, and it took participants about 30 min to finish ($M_{\text{time}} = 46$ min, $MDN = 22$ min). The data were collected as part of a larger study of prosocial behaviour in relation to socially controversial topics (COVID-19, vaccination, climatic changes). The participants were remunerated for their participation by the external agency according to an internal scoring system by credit points or vouchers.

2.2. Measures

Big Five personality traits we used the Slovak version (Halama et al., 2020) of the Big Five Inventory 2 short form (Soto & John, 2017). It

¹ <https://www.apa.org/ethics/code>.

Table 1
Descriptive information for all measured variables.

	M	MDN	SD	Minimum	Maximum
1. Vaccination behaviour	1.75	1.75	0.50	1	3
2. Anti-vaccination attitudes	2.78	2.70	1.01	1	5
3. Extraversion	3.24	3.17	0.72	1.17	5
4. Agreeableness	3.69	3.67	0.66	1.33	5
5. Conscientiousness	3.77	3.83	0.68	1.5	5
6. Negative emotionality	2.80	2.83	0.77	1	5
7. Openness	3.48	3.50	0.65	1.83	5
8. Horizontal collectivism	3.58	3.50	0.73	1	5
9. Vertical collectivism	3.39	3.50	0.70	1	5
10. Vertical individualism	2.92	3.00	0.88	1	5
11. Horizontal individualism	3.51	3.33	0.79	1	5
12. Future consequences	4.77	4.71	1.02	1	7
13. Immediate consequences	3.72	3.71	1.08	1	7
14. Helplessness	3.28	3.25	1.70	1	7
15. Threat COVID	4.62	4.67	1.44	1	7
16. Threat vaccination	3.80	4.00	1.97	1	7

contains 30 Likert scale items measuring five broad personality factors: Extraversion, Agreeableness, Conscientiousness, Negative Emotionality, and Open-Mindedness. Participants indicate their agreement or disagreement with the items using a 5-point scale ranging from “Disagree strongly” to “Agree strongly”. Cronbach's α were 0.74 (extraversion), 0.72 (Agreeableness), 0.76 (Conscientiousness), 0.76 (Negative Emotionality), and 0.67 (Openness).

Collectivism/Individualism was measured using the HVIC scale, which is a 14-item version (Sivadas et al., 2008) The scale comprises four subscales. *Horizontal Individualism* (HI) contains 3 items (e.g., “I enjoy being unique and different from others in many ways”), and Cronbach's α of the HI subscale was 0.63. Similarly, the *Vertical Individualism* (VI) subscale contains 3 items (e.g., “I enjoy working in situations involving competition with others”), and Cronbach's α of the VI subscale was 0.74. The *Horizontal Collectivism* subscale contains 4 items (e.g., “My happiness depends very much on the happiness of those around me”), and the Cronbach's α of the HC subscale was 0.72. Finally, the *Vertical Collectivism* subscale contains 4 items (e.g., “I usually sacrifice my self-interest for the benefit of my group”), with Cronbach's α of the VC subscale at 0.59. The HVIC scores are calculated by averaging relevant subscales items. Responses were made on a 5-point scale from *strongly disagree* (1) to *strongly agree* (5).

The *Consideration of Future Consequences* scale (CFC) describes the extent to which people consider the potential distant outcomes in their current behaviour (Joireman et al., 2012). The scale has 14 items forming two factors: CFC-Future (e.g., “When I make a decision, I think about how it might affect me in the future.”) and CFC-Immediate (e.g., “I only act to satisfy immediate concerns, figuring the future will take care of itself”). Cronbach's α of the CFC-F subscale was 0.85 and of the CFC-I it was 0.82. Each of the subscales comprise 7 items evaluated on a 7-point scale from *strongly disagree* (1) to *strongly agree* (7). The scores are obtained by averaging the relevant items.

Feelings of helplessness were measured with four items related to how a participant felt about COVID-19 vaccination, e.g. “I feel helpless when deciding about benefits and risks associated with COVID-19 vaccination.” Participants answered on a 7-point scale (1 = *completely disagree*, 7 = *completely agree*) and the mean score was used to indicate helplessness. Cronbach's α of the scale was 0.85.

Feelings of threat were measured by three items related to how threatened participants felt by COVID-19 and by three items related to how threatened participants felt by vaccination against COVID-19 when thinking about their health, quality of life, and economic and social consequences. Participants answered on a 7-point scale (1 = *not threatened at all*, 7 = *extremely threatened*). The mean score was calculated separately for the threat of COVID-19 ($\alpha = 0.84$) and the threat of vaccination ($\alpha = 0.95$).

Anti-vaccination attitudes. Ten items from Čavojević et al. (2022) were

used to measure negative attitudes towards vaccination. Six were adapted from Wallace et al. (2019) and four items were constructed by the authors. Participants indicated their agreement on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*). Higher scores indicated stronger anti-vaccination attitudes. Cronbach's α of the scale was 0.91.

Vaccination behaviour was measured using four self-reported items related to vaccination behaviour. Participants indicated whether they are vaccinated against flu, against COVID-19, actively persuade others to get vaccinated and their general behaviour towards vaccines (e.g. they refused to get their children vaccinated/took voluntary vaccines). Participants chose their answers from three options, and we assigned 1 point for answers indicating “no” (e.g. “I have never been vaccinated against flu”), 2 points for answers indicating some action/willingness (e.g. “I get vaccinated against flu only under specific circumstances”) and 3 points for answers indicating action (e.g. “I regularly get vaccinated against flu”). The mean score was used and Cronbach's α of the scale was 0.67.

Besides the measured variables, participants answered several other questions related to their demographic information, political attitudes and importance of religion.

2.3. Data analysis

To test most of our hypotheses, we used Pearson's correlational analyses and Spearman's correlational analyses for ordinal variables. In addition, to explore which factors would predict vaccination intentions and anti-vaccination attitudes better, we used hierarchical regression analysis.

3. Results

First, we performed correlational analyses to see how vaccination behaviour and anti-vaccination attitudes related to other measured variables (Table 2) and demographic factors (Table 3).

From the personality variables, only Conscientiousness correlated positively ($r = 0.13$) and Negative Emotionality negatively ($r = -0.10$) with vaccination behaviour; i.e. more conscientious people tended to get vaccinated more often, while people high in neuroticism tended to get vaccinated less often. On the other hand, anti-vaccination attitudes correlated positively with Extraversion ($r = 0.10$). Vaccination behaviour also correlated positively with vertical collectivism ($r = 0.14$), future consequences ($r = 0.13$) and the threat of COVID ($r = 0.10$), while it correlated negatively with immediate consequences ($r = -0.11$), helplessness ($r = -0.38$) and threat of vaccination ($r = -0.46$). Anti-vaccination attitudes correlated only with immediate consequences ($r = 0.25$), helplessness ($r = 0.50$), threat of COVID ($r = -0.11$), and threat of vaccination ($r = 0.56$) in opposite directions as vaccination behaviour.

Results (Table 3) show that both vaccination behaviour and anti-vaccination attitudes correlate with education, marital status and conservatism/liberalism. In other words, married and more liberal people with higher education expressed more positive attitudes towards vaccination and tended to get vaccinated more often. In addition, anti-vaccination attitudes were expressed by people with a higher number of people living in one household, while vaccination behaviour correlated positively with age.

Lastly, we were interested in whether vaccination behaviour and anti-vaccination attitudes are best predicted by demographic variables, personality variables, or feelings of threat and helplessness; therefore, we performed a pair of hierarchical regression analyses (Table 4). Vaccination behaviour and anti-vaccination were treated as outcome variables; demographic variables (gender, age, education, conservatism/liberalism, importance of religion) and personality variables as stable factors were entered in the first step, outward orientation variables (individualism/collectivism, and consideration for future vs. immediate consequences) in the second step, and emotional factors

Table 2
Descriptive statistics and correlations of all measured variables.

	M	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Vaccination behaviour	1.75	0.50	1														
2. Anti-vaccination attitudes	2.78	1.01	-0.70	1													
3. Extraversion	3.24	0.72	0.05	0.10	1												
4. Agreeableness	3.69	0.66	0.06	-0.03	0.20	1											
5. Conscientiousness	3.77	0.68	0.13	-0.06	0.43	0.42	1										
6. Negative emotionality	2.80	0.77	-0.10	-0.02	-0.39	-0.48	0.31	1									
7. Openness	3.48	0.65	0.06	0.01	0.40	0.36	0.36	-0.30	1								
8. Horizontal collectivism	3.58	0.73	0.07	0.01	0.35	0.43	0.33	-0.26	0.32	1							
9. Vertical collectivism	3.39	0.70	0.14	-0.06	0.21	0.36	0.25	-0.13	0.10	0.56	1						
10. Vertical individualism	2.92	0.88	0.08	0.01	0.28	-0.01	0.28	-0.16	0.09	0.29	0.28	1					
11. Horizontal individualism	3.51	0.79	-0.01	0.08	0.29	-0.03	0.13	-0.09	0.33	0.12	0.05	0.19	1				
12. Future consequences	4.77	1.02	0.13	-0.07	0.25	0.22	0.26	-0.12	0.30	0.37	0.31	0.20	0.24	1			
13. Immediate consequences	3.72	1.08	-0.11	0.25	0.03	-0.15	-0.11	-0.04	-0.10	0.01	0.05	0.14	0.10	-0.14	1		
14. Helplessness	3.28	1.70	-0.38	0.50	0.09	-0.05	-0.08	0.04	0.02	0.10	0.14	0.14	0.13	0.13	0.33	1	
15. Threat COVID	4.62	1.44	0.10	-0.11	0.03	-0.01	-0.02	0.18	-0.04	0.10	0.17	0.09	0.04	0.20	0.06	0.21	1
16. Threat vaccination	3.80	1.97	-0.46	0.56	0.05	-0.04	-0.05	0.04	0.04	0.12	0.16	0.09	0.10	0.11	0.29	0.64	0.26

Notes. Significant correlations are marked in bold. All correlations $r \geq 0.199$ are significant at $p < .001$; all correlations $r \geq 0.123$ are significant at $p < .01$; all correlations $r \geq 0.100$ are significant at $p < .05$.

Table 3
Correlations with demographic variables.

Correlations	Vaccination behaviour	Anti-vaccination attitudes
1. Gender (men = 0, women = 1)	-0.07	0.01
2. Age	0.11*	-0.06
3. Education ^a	0.19***	-0.21***
4. Marital status (married = 0, other [single, divorced, widowed] = 1)	-0.16***	0.11*
5. People in household	-0.07	0.10*
6. Conservatism/liberalism	0.15**	-0.21***
7. Importance of religion	-0.02	0.06

Notes. Significant correlations are marked in bold. All correlations $r \geq 0.193$ are significant at $p < .001$; all correlations $r \geq 0.152$ are significant at $p < .01$; all correlations $r \geq 0.097$ are significant at $p < .05$.

^a Spearman's correlation coefficient.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 4
Results of hierarchical linear regression predicting vaccination behaviour and anti-vaccination attitudes.

Predictor	Pro-vaccination behaviour		Anti-vaccination attitudes ^{*,**}	
	β	95% confidence interval	β	95% confidence interval
<i>Demographic & personality</i>	Adj. $R^2 = 0.068^{***}$		Adj. $R^2 = 0.097^{***}$	
Gender	-0.04	[-0.12, 0.04]	0.00	[-0.07, 0.07]
Age	0.10	[0.02, 0.17]	-0.06	[-0.13, 0.00]
Education	0.07	[0.00, 0.15]	-0.09	[-0.16, -0.03]
Conservatism/liberalism	0.10	[0.02, 0.18]	-0.12	[-0.19, -0.05]
Importance of religion	0.03	[-0.05, 0.10]	0.00	[-0.07, 0.07]
Extraversion	-0.02	[-0.11, 0.07]	0.12	[0.04, 0.20]
Agreeableness	-0.09	[-0.18, 0.00]	0.08	[0.00, 0.16]
Conscientiousness	0.01	[-0.09, 0.10]	-0.01	[-0.10, 0.07]
Negative emotionality	-0.07	[-0.16, 0.03]	0.01	[-0.08, 0.09]
Openness	0.05	[-0.03, 0.14]	-0.03	[-0.11, 0.05]
<i>Outward orientation</i>	$\Delta R^2 = 0.023^{***}$		$\Delta R^2 = 0.046^{***}$	
Hierarchical collectivism	-0.01	[-0.11, 0.09]	-0.01	[-0.10, 0.08]
Vertical collectivism	0.17	[0.07, 0.26]	-0.13	[-0.22, -0.05]
Vertical individualism	0.02	[-0.06, 0.11]	-0.01	[-0.09, 0.06]
Hierarchical individualism	0.00	[-0.08, 0.08]	0.01	[-0.07, 0.08]
Future consequences	0.10	[0.02, 0.19]	-0.06	[-0.14, 0.01]
Immediate consequences	0.07	[-0.01, 0.15]	0.04	[-0.03, 0.11]
<i>Emotional factors</i>	$\Delta R^2 = 0.257^{***}$		$\Delta R^2 = 0.325^{***}$	
Helplessness	-0.18	[-0.28, -0.09]	0.23	[0.15, 0.32]
Threat COVID	0.22	[0.14, 0.30]	-0.26	[-0.33, -0.19]
Threat vaccination	-0.44	[-0.53, -0.34]	0.46	[0.38, 0.55]
<i>Full model</i>	Adj. $R^2 = 0.342^{***}$		Adj. $R^2 = 0.467^{***}$	

Notes. The columns represent the standardised coefficients for every predictor taken from the final regression model. ΔR^2 represents the change in R2 at the first, second, and third step of the model. Values significant at $p < .05$ are presented in bold. Gender: men were coded as 1 and women as 2.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

† $p = .054$.

(helplessness, threat of COVID and threat of vaccination) in the third step.

Analyses showed that the explained variance of demographic and

personality factors, though statistically significant – mostly age and political worldviews – was rather low (6.8% for vaccination behaviour and 9.7% for anti-vaccination attitudes). In the case of anti-vaccination beliefs, lower education and higher extraversion were also significant predictors. Vertical collectivism was the only significant predictor for both vaccination behaviour and anti-vaccination attitudes. Additionally, vaccination behaviour was also predicted by consideration for future consequences. However, adding outward orientation added only a small percentage of explained variance (2.3% for vaccination behaviour and 4.6% for anti-vaccination attitudes). For both vaccination behaviour and anti-vaccination attitudes the most significant predictors proved to be emotional factors; when helplessness, threat of COVID-19 and threat of vaccination were added to the model, the explained variance increased to 25.7% and 32.2% for vaccination behaviour and attitudes, respectively.

4. Discussion

The study explored the relative weights of sociodemographic characteristics, personality, collectivism and individualism, consideration of future consequences, and feelings of threat and helplessness in explaining vaccination attitudes and behaviour. The results indicate that both vaccination attitudes and behaviour – apart from being strongly related – share similar predictors.

4.1. Emotion-driven response to vaccination

Specifically, the emotion-driven antecedents investigated in this study show opposite, yet similarly strong relations with both dependent variables. Therefore, the most important finding is that fear of the vaccine outweighs not only fear of the disease but also the collectivistic and future-oriented tendencies a person may have. Although formally higher vaccination rates contribute to the public good of herd immunity, the decision to take the vaccine is mostly driven by an individual's intrinsic emotional responses to vaccine safety rather than their other-regarding preferences.

These results are in line with [Karlsson et al. \(2021\)](#), who collected their data during the first wave of the pandemic when the threat of the disease was high and vaccination was not yet available, so people only expressed intentions concerning a hypothetical vaccine. Our data were collected more than one year later, after Slovakia was hit hard by the second wave of the pandemic (with over 19,000 COVID-related fatalities, Slovakia ranks fifth in the EU in terms of deaths per million population). Still, emotion-driven factors, such as fear of the vaccine and helplessness in assessing safety and benefits of inoculation, have the greatest potential to explain both vaccination behaviour and anti-vaccination attitudes.

The specific national context of our study indicates that the results should be interpreted and generalised with caution. Slovakia is among the three EU countries with lowest vaccination rates, outperforming only Romania and Bulgaria. With slightly over 50% of the population being fully vaccinated against COVID-19, Slovakia is nearly 20% behind the EU average ([European Centre for Disease Prevention and Control, 2021](#)). More troubling, though, is the fact that only 30% of the population took a booster dose – making herd immunity, if not an unreachable, at least a distant goal. One of the reasons believed to have a crucial role in shaping this unfavourable picture is the popularity of conspiracy theories and misinformation about the vaccines, which often outweigh official health communications ([Čavojoová et al., 2022](#)). Consequently, our results could inform interventions needed to increase vaccination rates among particularly hesitant individuals or communities that are still far from achieving herd immunity. However, in countries where COVID-related misinformation is less widespread, other, non-emotional factors supporting or hindering vaccination rates could come to the foreground.

4.2. Vaccination as a prosocial behaviour

One of our main aims and a unique contribution was to examine the role of outward orientation (i.e., collectivism and consideration of future consequences) in vaccination. In line with our expectations, vertical collectivism and consideration for future consequences were both significant predictors of vaccination behaviour. However, their effect – compared to emotion-driven factors – is weaker. The result corroborates the findings that prosocial appeals to vaccinate may be most effective when financial barriers and health-related costs are perceived as low ([Betsch et al., 2017](#)). Thus, together with the findings concerning emotional responses, our results could explain why appeals to solidarity or common good often prove ineffective. While people may sincerely wish for others to remain safe and healthy, their prosocial sentiments seem to be nullified by personal worries concerning vaccine safety and their sense of helplessness in assessing it. The result also corroborates previous findings concerning vaccination against HPV indicating that – in addition to being a parent – having reliable knowledge about the vaccine was the strongest individual predictor of intentions to vaccinate children ([Liu et al., 2019](#)). In the absence of such knowledge – as attested to by the participants' sense of helplessness – outward or prosocial tendencies give precedence to immediate and self-oriented emotional responses.

The results corroborate the dual view of human cognitive processes stressing the primacy of emotion-driven responses over deliberate reasoning (e.g., [Engelmann & Hare, 2018](#); [Stanovich, 2011](#)). Considerations for others' and own future benefits are strongly related to overcoming narrow, present-oriented self-interest. Other-regarding and future-oriented behaviour requires considerable cognitive effort that could be attributed to the analytical system. Although we expected outward orientation to be strongly related to vaccination attitudes and behaviour, the data show that once self-control is distorted by strong emotions, specifically fear or helplessness, any prosocial tendencies a person may have tend to be of minor importance. In other words, to overcome worries related to vaccine safety – and thus the vaccine hesitancy or refusal – it is necessary to suppress emotion-driven fast responses. However, under strong emotional strain, an individual's capacity to manage emotions may be depleted, and thus an individual falls prey to decisions that are non-optimal not only from the public good point of view but also the individual's own health and safety ([Engelmann & Hare, 2018](#)).

4.3. The role of personality in shaping vaccination attitudes and behaviour

Finally, in our study personality characteristics turned out to be unrelated to vaccination attitudes and behaviour, when other factors were taken into account. Surprisingly, Extraversion was the only significant personality-related predictor and was positively related to anti-vaccination intentions. We can only speculate that more extraverted people have different information search patterns ([Lin & Wang, 2020](#)) and, thus, they possibly encounter more disinformation about vaccination. Importantly, previous studies show that Extroversion proved to be related to less adherence to preventive measures during lockdowns and more pseudoscientific beliefs ([Carvalho et al., 2020](#); [Čavojoová et al., 2022](#); [Ludeke et al., 2021](#)), and also with more beliefs in human-related myths ([Swami et al., 2012](#)). Our findings contribute to the mixed picture concerning the relation between personality and compliance with containment measures. For instance, Lin and Wang ([Lin & Wang, 2020](#)) pointed out that certain personality characteristics may make individuals more receptive to informational cues and, consequently, change their attitudes towards vaccination to being more favourable. However, [Betsch et al. \(2018\)](#) observed that extensive information searching could be one of the factors decreasing one's willingness to get vaccinated.

Interestingly, although sociodemographic characteristics showed to

be related to both vaccination attitudes and behaviour, they jointly explained less than 10% of the variation. In the hierarchical regression, their effect was lost once personality, outward orientation and emotion-driven factors were added to the model. The fact that sociodemographic factors have relatively little weight in developing vaccination attitudes and behaviour adds practical significance to our findings and boosts the study's contribution. Specifically, it indicates that the present results apply to a broad group of people regardless of their demographics or socioeconomic background.

5. Conclusions

Apart from contributing to the understanding of factors underlying vaccination attitudes and behaviour, our study has considerable implications for practice. Particularly, with the advance of more contagious COVID-19 variants (e.g., delta or omicron), achieving herd immunity requires increased and accelerated actions. Although it is indisputable that herd immunity is a public good, interventions calling for more prosociality have proven ineffective in many countries, including Slovakia. Moreover, strategies appealing to people's self-interest (lotteries, additional leave days or exemption from quarantine for fully vaccinated people) have also shown a negligible effect on vaccination rates. Our findings provide an explanation for this limited effectiveness of encouragement campaigns. Even though people report considerable levels of collectivism and future orientation, when considering vaccination, they seem to be more inwardly-oriented. Despite being obtained in a specific context, our findings provide a warning signal for the future and for other countries, as well. Leaving space for misinformation and conspiracies to shape the debate on public health and vaccination was a regrettable mistake that has cost – as the statistics show – thousands of lives and caused unnecessary distress and confusion. Worse still, the harm done by undermining confidence in vaccination has the potential to spill over from the pandemic context. Specifically, it could hamper effectiveness of other vaccinations campaigns (e.g., against human papilloma virus, HPV) and general public health appeals.

To counterbalance or prevent immediate emotional responses to vaccines, it would therefore be advisable to focus more on explaining the scientific process that led to the vaccine's development, debunk pseudoscientific myths and conspiracies – preferably before they manage to spread – and provide people with knowledge enhancing both their actual competence and sense of self-efficacy in evaluating the currently available (and future) vaccine safety. In other words, it seems to be necessary to directly address people's fears and helplessness with reliable, transparent and trustworthy communications formulated in clear language that would compensate for people's negative, emotion-driven attitudes towards vaccines.

Declaration of competing interest

The authors hereby declare that they have no conflicts of interests to declare.

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