



## Moral values and vaccination behavior in Russia during the COVID-19 pandemic

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### ABSTRACT

**Objective:** Effective persuasive communication necessitates message matching; the conveyed message should resonate with the recipient's characteristics, including individual moral values. While studies examining the relationship between moral values and vaccination behavior have been conducted in a limited number of countries, this study seeks to provide evidence on this relationship beyond Western democracies.

**Methods:** A cross-sectional online survey was conducted from November 4 to December 17, 2021, in Russia. Participants reported their COVID-19 vaccination behavior and completed the Moral Foundations Questionnaire, designed to measure the endorsement of moral values ( $n = 415$ ). Regression analysis was employed to assess the association between each moral foundation and COVID-19 vaccination behavior.

**Results:** Our findings indicate that the moral foundations of Care, Loyalty, Fairness, and Sanctity significantly influence vaccination behavior. Individuals who strongly endorse Fairness (AME =  $-0.019$ ; 95 % CI =  $-0.033, -0.005$ ) and Sanctity (AME =  $-0.016$ ; 95 % CI =  $-0.031, -0.002$ ) were less likely to be vaccinated. Conversely, individuals endorsing Care (AME =  $-0.018$ ; 95 % CI =  $-0.031, -0.005$ ) and Loyalty (AME =  $-0.015$ ; 95 % CI =  $-0.028, -0.001$ ) were less likely to report refusal of vaccination. These results remain robust after adjusting for sociodemographic variables related to vaccination barriers.

**Conclusion:** Our findings carry public health implications; an understanding of the moral psychology underlying vaccination behavior can facilitate more targeted and effective health communication. Employing skillfully crafted moral appeals may mitigate negative attitudes toward vaccination and enhance vaccination rates.

### 1. Introduction

Vaccination is one of the safest and most cost-efficient public health interventions. Mass vaccination programs led to the eradication of some of the deadliest diseases, such as smallpox, and allowed to contain the spread of other diseases, such as measles or rubella. Despite these facts, decreasing rates of vaccinations for various diseases have become an important problem worldwide. In 2019, WHO listed vaccine hesitancy among the top ten global threats to public health (World Health Organization, 2019).

The resurgence of vaccine-preventable diseases became a global

threat long before the COVID-19 pandemic. In countries where vaccination programs were severely affected by the antivaccination movement, in the 1990s pertussis incidence was 10 to 100 times higher compared to the countries with high coverage with diphtheria-tetanus-pertussis vaccines (Gangarosa et al., 1998). In 1992, following a 14-year absence of endemic cases, the Netherlands encountered an outbreak of poliomyelitis that impacted 71 individuals, resulting in two fatalities and leaving 59 individuals paralyzed. None of the afflicted individuals had received vaccination, with a majority declining vaccination due to religious beliefs (Oostvogel et al., 1994; van Spaendonck et al., 1996). In 2002, the outbreak of rubella happened in the Netherlands with 128

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people affected. Again, all the patients had been unvaccinated, the majority of them for religious reasons. During 2018–2019 Israel experienced a nationwide epidemic of measles that was at least partly driven by the low vaccination rate among the Orthodox Jewish community (Salama et al., 2021; Stein-Zamir et al., 2020). In the same year, New York and New Jersey in the US also experienced an outbreak of measles in the Orthodox Jewish community (McDonald et al., 2019). The onset of the COVID-19 pandemic raised the stakes of vaccination coverage significantly. According to Barro (2022), 124 full vaccination was enough to save one life in the US in September–November of 2021. Thus, since the pandemic's start vaccine-related behavior has attracted considerable attention from the researchers.

Vaccine hesitancy was defined by the World Health Organization Strategic Advisory Group of Experts as 'delay in acceptance or refusal of vaccination despite availability of vaccination services' (MacDonald, 2015). There is an extensive body of research on factors that are associated with vaccine hesitancy (Dubé et al., 2018; Larson et al., 2014; Troiano and Nardi, 2021; Williams, 2014), but it is still unclear what lies in the foundation of anti-vaccination attitudes. Researchers are actively seeking theoretical frameworks that can facilitate the identification of both correlates of vaccine refusal and the underlying motivations driving individuals to reject vaccination.

Many studies relied on Health Belief Model (HBM) as a theoretical framework to specify factors associated with vaccine hesitancy. HBM explains health-related behavior by the threat perception and benefits/barriers evaluation. When the perceived threat is high and the perceived benefits of an intervention are greater than the costs associated with overcoming the perceived barriers, people are more likely to engage in health-related behavior. The extended model also includes cues to action and self-efficacy, but these concepts are rarely included in quantitative studies. The theory assumes that people use available information to make rational decisions, and this assumption has drawn heavy criticism (Christensen et al., 1999; Janis, 2020; Obregon and Rafael, 2000). Empirical testing of the HBM brought inconsistent results. In a meta-analysis of 18 studies exploring different health behaviors, Carpenter (2010) concludes that some of the HBM constructs, namely susceptibility, and severity, turn out to be very weak predictors of behavior, while benefits and barriers were consistently the strongest predictors. Communication strategies based on the HBM tend to be educational, as people behaving in an 'incorrect' way are assumed to lack information about the threat of the disease or the risks and benefits of taking action. In the context of vaccination, the effectiveness of communication efforts aimed at rectifying misinformation propagated by the 'anti-vax' movement has been determined to be inconclusive at best (Carolan et al., 2018; Pluviano et al., 2017).

The research results described above may suggest that vaccination attitudes are grounded in deeper intuitions and not in a lack of knowledge on vaccination. There is evidence that vaccination attitudes and behavior are correlated with a wide range of factors that have no relation to the benefits and costs of vaccination. Thus, opposition to vaccination is associated with political ideology and conspiracy theory beliefs (Baumgaertner et al., 2018; Debus and Tosun, 2021; Hornsey et al., 2020; Ward et al., 2020), including those unrelated to vaccination (Goldberg and Richey, 2020; Pivetti et al., 2021a; Pivetti et al., 2021b). Vaccine hesitancy is also found to be associated with the emotion of disgust (Clifford and Wendell, 2016; Luz et al., 2019). Other-oriented emotions, such as empathy, are also found to be related to vaccine advocacy (Böhm and Betsch, 2022; Luong and Moyer-Gusé, 2021; Wells et al., 2020). Communication strategies that rely on emotional rather than intellectual appeal have shown some efficiency (James et al., 2021; Li et al., 2016). The emotions that people experience about vaccination are closely related to moral values the individuals endorse, as disgust is a reaction to a violation of purity and pro-social motivation reflects the value of care about others.

As moral principles are involved in the vaccination decision, individuals may become insensitive to "objective" arguments as they

believe their attitudes reflect their fundamental values (Luttrell et al., 2019; Walter and Murphy, 2018). In this case, an effective persuasion strategy should utilize moral reframing – organizing the message around moral issues in a way that changes the individual's perception of a particular issue from morally wrong to morally right (Feinberg and Willer, 2019). Moral reframing necessitates a congruence between the message and the recipient's values, as incongruence can amplify the individual's opposition to the issue (Koleva et al., 2012). Consequently, it is imperative to investigate the moral values underpinning vaccine hesitancy, enabling health communicators to tailor messages that align with these values.

This study seeks to explore the relationship between moral values and vaccination behavior in Russia. The framework we rely on in this study to explore the differences between the moral values of individuals supporting and rejecting vaccination is the Moral Foundation Theory (MFT). According to MFT, human decisions are guided by intuitive emotional responses (Haidt and Joseph, 2004). These emotional responses originate from five core moral foundations: Care, Fairness, Loyalty, Authority, and Sanctity. Care refers to the need to protect others, especially the weak and vulnerable. The foundation of Fairness is concerned with pursuing justice and can be related to ideas of equality and reciprocity. Loyalty promotes the values of unity, patriotism, and loyalty to the social or ethnic group. Authority relates to obedience to authority and respect for traditional hierarchical social structures. Finally, Sanctity promotes physical and metaphorical purity.

Although initially developed in the field of cultural psychology, MFT has expanded its reach to various disciplines. Research has demonstrated that an individual's alignment with a specific political ideology can be elucidated by their dominant moral foundations. The moral foundations of Care and Fairness are related to individual relationships between people, so they are grouped under the name of individualizing moral foundations (Graham et al., 2009). The moral foundations of Loyalty, Authority, and Sanctity guide the relationship between a person and his community; they are called binding moral foundations. Studies using both questionnaires and content analysis of texts have shown that the liberals value individualizing moral foundations more than conservatives, and conservatives value binding foundations more than liberals (Haidt et al., 2009; Iyer et al., 2012). As political ideologies are found to be related to vaccine attitudes and behaviors, these results can indicate that examining of moral foundations can be used to explain vaccine hesitancy.

Existing research on the relationship between moral foundations and vaccine hesitancy has been carried out in a limited set of countries, all of them WEIRD (Western, educated, industrialized, rich, democratic): the US (Amin et al., 2017; Reimer et al., 2022), Great Britain (Schmidtke et al., 2022) and Australia (Rossen et al., 2019). WEIRD cultures are characterized by social values that distinguish them from other cultures. While there is evidence that the five-factor model of the MFT is stable across both WEIRD and non-WEIRD cultures (Doğruyol et al., 2019), the relationship between moral foundations and vaccination behavior in non-WEIRD countries is not yet explored. To the best of our knowledge, it is the first study exploring the association between moral foundations and vaccine hesitancy outside of Western democratic countries.

## 2. Methods

The study utilized the snowball sampling method to recruit participants, with respondents being encouraged to invite new participants from their networks. The initial respondents were contacted by the research team through personal connections. Particular efforts were made to include subjects from various regions of Russia, each of which had been affected by the COVID-19 pandemic to varying degrees. Data were collected using anonymous online self-report surveys delivered by Google Forms on 4 November - 17 December 2021. The use of snowball sampling and a self-administered mode offers significant advantages in these circumstances, as it enables the collection of more reliable

responses on a sensitive issue such as vaccination behavior. The self-administered mode allows respondents to disclose socially undesirable behavior (Tourangeau and Yan, 2007). Eligible participants were individuals aged 18 or older who were residing in Russia during the pandemic. Notably, 133 vaccinated individuals who reported being coerced to vaccinate by their employer were excluded from the study, as our focus is on exploring vaccination behavior driven by internal values rather than external coercion. A total of 608 individuals were surveyed; after excluding entries with missing information and ineligible individuals, the final sample size comprised 415 respondents (refer to Fig. 1 for the study participant flowchart).

The study protocol was approved by the Ethics Committee of the St.-Petersburg association for sociologists. All respondents provided informed consent. Participants could withdraw from the survey at any moment without providing any justification.

### 3. Measures

#### 3.1. Moral foundations

To capture participants' endorsement of moral foundations, the Moral Foundation Questionnaire was used (Graham et al., 2011). The Russian version of the questionnaire was validated by Sychev et al. (2018). The questionnaire allows calculating scores for five moral foundations (Care, Fairness, Loyalty, Authority, and Sanctity). There are 6 questions related to every foundation, with answers being six-point Likert scales. The scores are calculated by adding up six items. The scores for foundations run from 0 to 30. Higher scores indicate stronger endorsements.

#### 3.2. Vaccination behavior

The participants were asked, "Have you been vaccinated against COVID-19? (Choose 'Yes' if you were vaccinated with at least one of the components of a two-component vaccine.)". The answers included three categories: 'Yes', 'No, but plan to', 'No, and do not plan to'. By the time the survey was conducted, the vaccine had already been available for 11 months with an active public campaign to promote vaccination.

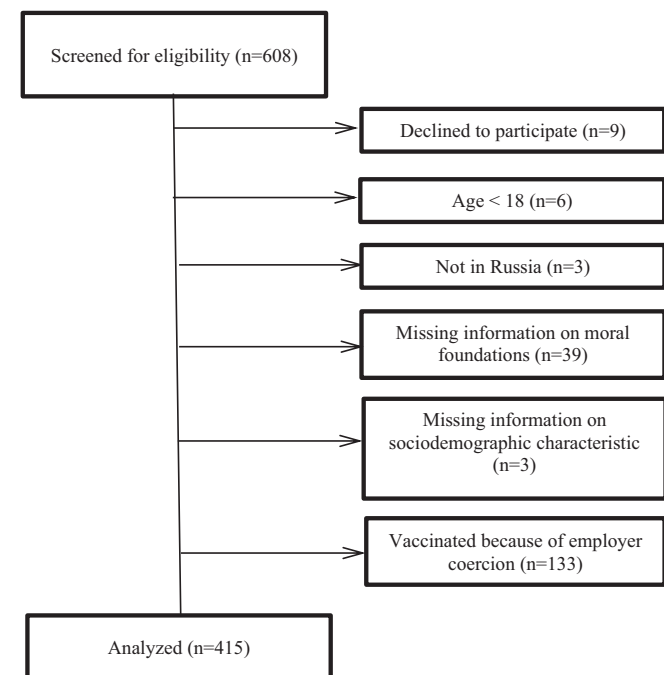


Fig. 1. Flowchart depicting study participant selection among Russian adults in 2021.

### 3.3. Demographic and socioeconomic characteristics

Participants reported their gender, age (categorized into '18–24', '25–44', and '45+'), education (dichotomized into 'university degree' and 'no degree' as the majority of the sample had higher education), marital status (married or single/divorced/widowed), and size of the city where the individual lives (dichotomized into 'more than one million', 'one million and less'). Participants were classified as belonging to a high-risk group if they had underlying medical conditions that put them at high risk of serious, life-threatening complications from COVID-19: cancer, chronic kidney disease, chronic obstructive pulmonary disease, heart conditions (heart failure, coronary artery disease, cardiomyopathies, or hypertension), diabetes (type 1 or type 2), and hepatitis.

### 4. Analysis

To ensure internal consistency of moral foundation scales, Cronbach's alpha was calculated, with the value ranging from 0.67 for Care foundation to 0.73 for Sanctity (Supplementary Table 1). Both unadjusted and adjusted for sociodemographic characteristics models were estimated. As the dependent variable is multinomial and differentiates between three outcomes (vaccinated, unvaccinated, but willing to get vaccinated, and unvaccinated and not willing to get vaccinated), multinomial logistic regression was used.

To quantify the impact of moral foundations endorsement on vaccination behavior, we utilize average marginal effects (AMEs). These effects indicate how the predicted probability of a specific outcome changes with variations in predictors, offering a means to present results as probability differences. Given that moral foundations are treated as continuous variables, interpreting marginal effects is more straightforward compared to odds ratios. For instance, a one-unit increase in endorsement of the Care foundation (ranging from 0 to 30) correlates with a 1.8 % decrease in the probability that an individual remains unvaccinated and unwilling to receive vaccination, when adjusting for sociodemographic characteristics in our model. Since the probabilities of the three potential outcomes sum to 1, an increase in the probability of one outcome correlates with a decrease in the probability of at least one other outcome. We estimate two multinomial logistic regressions: one unadjusted and one adjusted for sociodemographic characteristics. Analyses were run in Stata 16 (Stata Corp. LLC, College Station, TX, USA).

### 5. Results

The mean age of participants was 35.3 years (SD = 14.4). The sample was predominantly female (72.3 %), with higher education (74.9 %) and living in cities with a population of more than one million (69.9 %). As the sample is relatively young, only 42.4 % of the sample were married, and 19.8 % were classified as high-risk due to underlying medical conditions that would put them at high risk of serious, life-threatening complications in the event of contracting COVID-19. In Table 1 we present the characteristics of the study sample, stratified by vaccination status.

Fig. 2 shows the adjusted AMEs for three possible outcomes of vaccination status depending on the levels of five moral foundations. The outcome is predicted with multinomial logistic regression. Estimates are adjusted for the other moral foundations and socioeconomic characteristics (gender, age, education, marital status, city size, COVID-19-related risk). Table 2 provides AMEs estimates and 95 % confidence intervals (CI) for both unadjusted and adjusted models.

Higher endorsements of Care (AME = -0.0178; 95 % CI = -0.031, -0.005) and Loyalty (AME = -0.0147; 95 % CI = -0.028, -0.001 are associated with a reduced likelihood that an individual will be unvaccinated and not willing to vaccinate, indicating that a one-unit increase in Care and Loyalty decreases the probability of this outcome by 1.78

**Table 1**  
Descriptive statistics of vaccination status COVID-19 among Russian adults in 2021, n (%).

Characteristic*	Vaccinated (n = 255)	Unvaccinated, but willing to (n = 55)	Unvaccinated, and not willing to (n = 105)
Gender			
Male	77 (30.2)	10 (18.2)	28 (26.7)
Female	178 (69.8)	45 (81.8)	77 (73.3)
Age			
18–24	92 (36.1)	25 (45.5)	29 (27.6)
25–44	101 (39.6)	13 (23.6)	43 (41.0)
45+	62 (24.3)	17 (30.9)	33 (31.4)
Education			
With university degree	192 (75.3)	39 (70.91)	80 (76.2)
Without university degree	63 (24.7)	16 (29.1)	25 (23.8)
Marital status			
Married	107 (42.0)	26 (47.3)	43 (41.0)
Single/divorced/ widowed	148 (58.0)	29 (52.7)	62 (59.1)
City size			
> one million population	181 (71.0)	39 (71.0)	70 (66.7)
≤ one million population	74 (29.0)	16 (29.1)	35 (33.3)
High-risk due to underlying medical condition			
Yes	47 (18.4)	13 (23.6)	22 (21.0)
No	208 (81.6)	42 (76.4)	83 (79.1)

\* Note that percentages may not sum to 100 due to rounding.

and 1.47 percentage points. Conversely, greater endorsement of Sanctity is associated with increase of the likelihood that an individual will be unvaccinated and not willing to vaccinate (AME = 0.0201; CI = 0.007, 0.033, indicating that a one-unit increase in Sanctity raises the probability this outcome by 2.01 percentage points). Higher endorsements of Fairness (AME = -0.0188; CI = -0.033, -0.005) and Sanctity (AME = -0.0165; CI = -0.031, -0.002) are associated with lower likelihood that an individual will be vaccinated, one-unit increases in Fairness and Sanctity are related to 1.88 and 1.65 % points decrease in the probability of being vaccinated, respectively).

The results obtained are robust to including sociodemographic variables that can be related to barriers to vaccination, as the same moral foundations are statistically significant in predicting vaccination behavior in both unadjusted and adjusted models.

## 6. Discussion

This study presents the first evidence relating to the relationship between moral values and vaccination behavior in non-Western countries. We found that the moral foundations of Care, Loyalty, Fairness, and Sanctity were statistically significantly associated with vaccination behavior. While higher endorsements of Care and Loyalty were associated with higher rates of vaccination, higher endorsements of Sanctity and Fairness were associated with lower rates of vaccination. We found no statistically significant association between the moral foundation of Authority and vaccination behavior.

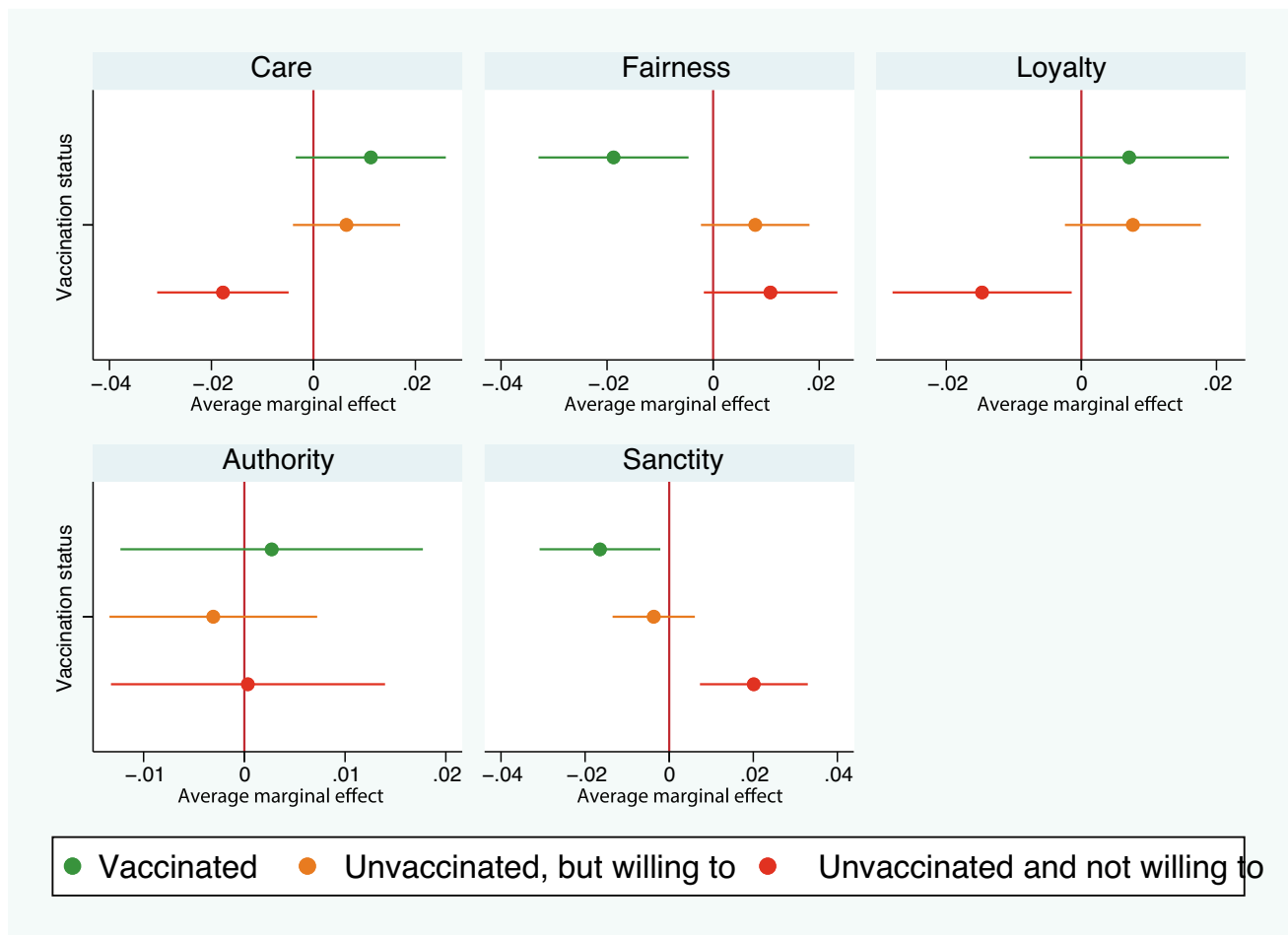
Our results differ from the previous findings in two respects. First, we observe that a higher endorsement of Fairness is associated with a lower probability of an individual being vaccinated, while Amin et al. (2017), Rossen et al. (2019), Schmidtke et al. (2022) found no relationship

between endorsement of Fairness and vaccine hesitancy, and Reimer et al. (2022) showed that a higher score of Fairness was associated with higher vaccination rates. Second, unlike Amin et al. (2017), Rossen et al. (2019), and Schmidtke et al. (2022), we find no evidence that endorsement of Authority is related to vaccination behavior. The existing body of research on the association between moral values and vaccine hesitancy is based on samples drawn from WEIRD countries. These countries are characterized by high levels of interpersonal trust, high confidence in public institutions, and high social cohesion. In contrast, Russian society exhibits significant atomization, characterized by low general trust and social cohesion (Ruiz et al., 2019). Consequently, individuals perceive their obligations as limited to family and close communities, rejecting the notion that society can mandate vaccinations. Fairness is often interpreted as the right to individual autonomy in decision-making. Moreover, the finding that Authority endorsement does not correlate with vaccination behavior is surprising, contradicting the theoretical expectation that authoritarian regimes with strong leader support would show a positive relationship between Authority endorsement and compliance with governmental measures.

Discrepancies in findings across studies can be attributed to the unique context of the COVID-19 pandemic. While research on parental decisions regarding childhood vaccinations reveals no significant relationship (Amin et al., 2017) or a positive association (Rossen et al., 2019) between vaccine hesitancy and endorsement of the Care foundation, studies focused on COVID-19 vaccination indicate that individuals with stronger Care endorsement are less prone to vaccine hesitancy (our study; Reimer et al., 2022; Schmidtke et al., 2022). This difference is likely due to the pandemic's heightened risk, particularly for the elderly and those with underlying health conditions, prompting individuals with high Care endorsement to prioritize vaccination for the sake of others. Additionally, earlier studies (Amin et al., 2017; Rossen et al., 2019) showed no correlation between Loyalty and vaccination attitudes, whereas our study and that by Reimer et al. (2022) demonstrate a link between lower Loyalty endorsement and increased vaccine hesitancy.

Finally, similar to Amin et al. (2017), Rossen et al. (2019), Reimer et al. (2022), and Schmidtke et al. (2022), we found that higher endorsement of the Sanctity foundation is associated with vaccination refusal. This result is also in line with the literature exploring the relationship between the emotion of disgust and vaccine hesitancy (Clifford and Wendell, 2016; Luz et al., 2019). The association between Sanctity foundation and vaccine hesitancy is the most robust finding of the research literature on the relationship between morality and vaccination.

Our findings have public health implications as the low rates of vaccinations for various diseases remain a major challenge for public health worldwide. A deeper understanding of the moral psychology of vaccination behavior can allow for more targeted and efficient health communication strategies. While the 'knowledge-deficit' approach is found to be suboptimal, public health strategies that rely on skillfully crafted moral appeals can reduce negative attitudes toward vaccination and increase vaccination rates (Carolan et al., 2018; Pluviano et al., 2017). This approach was tested with regard to environmental issues in the US by Wolsko et al. (2016). Their results indicate that while conservatives tend to show less concern about environmental issues, framing messaging in terms of binding moral foundations (Authority, Loyalty, and Sanctity) can shift their attitudes and behavior. Even though this technique has not yet been tested in interventions focused on shaping attitudes toward vaccination, the results of our study and the previous studies on the association between moral values and vaccine hesitancy indicate that it can be a productive approach. A message framed in terms of the Sanctity foundation may read, 'Keep yourself pure of infection – Vaccinate!' (Amin et al., 2017). Our findings also support evidence that caring about others can be an important driver of vaccination during the COVID-10 pandemic (Jung and Albarracín, 2021). The intervention framed in terms of the Care foundation might read, 'Protect



**Fig. 2.** Average marginal effects and 95 % confidence intervals from adjusted multinomial logistic regression of associations between moral foundations and COVID-19 vaccination status among Russian adults ( $n = 415$ ), controlling for gender, age, education, marital status, city size, and COVID-19-related risk factors, 2021.

your loved ones from the infection – Vaccinate!’

The messaging utilized in Russia’s 2021 vaccination campaign was mostly not consistent with the principles described above (Supplementary File 1). The relatively inefficient health communication strategy used in the vaccination campaign could have contributed to the fact that, despite being the first country in the world to approve the vaccine against COVID-19 for widespread use (August 11, 2020), Russia’s rate of vaccination was low compared to both developed countries and the world average (Tran et al., 2021., Roshchina et al., 2022). On December 31, 2021, the share of people vaccinated with at least one shot of the vaccine was 51 % in Russia, while in the UK it was 77 %, in the US it was 73 %, in the EU countries it was 72 %, and the world average was 58 % (Mathieu et al., 2020).

This study has several limitations. First, as we rely on a convenience sample, our findings may lack generalizability. Snowball recruitment using social media leads to a self-selected sample that is not representative of the population of Russia as a whole. Results may have gender and education biases. Also, online surveys are less likely to reach those who do not have internet access or computer literacy, both of which may be correlated with vaccination attitudes and moral foundations. The second limitation is the lack of the ability to draw causal conclusions from our findings as our research design is cross-sectional. Experimental evidence is needed to identify whether the moral framing of pro-vaccination messaging affects vaccination attitudes and behavior. Despite these limitations, our study provides novel evidence relating to the relations between moral values and vaccination behavior in non-WEIRD countries and allows for a better understanding of cultural mechanisms determining vaccine hesitancy that will enable public

institutions to improve messaging interventions used to encourage vaccination.

Overall, the current study adds to the body of evidence indicating a link between vaccination behavior and moral values. Given the ongoing erosion of trust in healthcare institutions over time (Brady and Kent, 2022; Mechanic, 1996; Stevens, 2001), it is plausible that individual cultural and moral values will increasingly influence health-related decision-making. Further investigation into the factors influencing moral intuitions may represent a valuable avenue for research, not only concerning vaccine hesitancy but also for understanding various health-related behaviors.

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**CRediT authorship contribution statement**

**Dmitry Kisilitsyn:** Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Formal analysis. **Peter Mey-lakhs:** Writing – review & editing, Conceptualization. **Dmitry Schapov:** Writing – review & editing, Conceptualization, Formal analysis. **Dmitry Kurakin:** Writing – review & editing, Conceptualization. **Ekaterina Aleksandrova:** Writing – review & editing, Conceptualization, Data curation.

**Table 2**

Average marginal effects and 95 % confidence intervals from multinomial logistic regression of associations between moral foundations and COVID-19 vaccination status among Russian adults (n = 415), 2021.

	Vaccinated		Unvaccinated, but willing to		Unvaccinated and not willing to	
	(1)	(2)	(1)	(2)	(1)	(2)
<b>Moral foundations</b>						
Care	0.007 [-0.007,0.021]	0.011 [-0.003,0.026]	0.009 [-0.001,0.018]	0.006 [-0.004,0.017]	-0.015* [-0.027,-0.003]	-0.018** [-0.031,-0.005]
Fairness	-0.017* [-0.031,-0.003]	-0.019** [-0.033,-0.005]	0.007 [-0.003,0.017]	0.008 [-0.002,0.018]	0.010 [-0.002,0.023]	0.011 [-0.002,0.023]
Loyalty	0.008 [-0.007,0.023]	0.007 [-0.008,0.022]	0.006 [-0.004,0.016]	0.008 [-0.002,0.018]	-0.014* [-0.027,-0.001]	-0.015* [-0.028,-0.001]
Authority	0.002 [-0.013,0.017]	0.003 [-0.012,0.018]	-0.002 [-0.012,0.008]	-0.003 [-0.013,0.007]	0.000 [-0.013,0.014]	0.000 [-0.013,0.014]
Sanctity	-0.016* [-0.030,-0.002]	-0.016* [-0.031,-0.002]	-0.003 [-0.013,0.006]	-0.004 [-0.013,0.006]	0.020** [0.007,0.032]	0.020** [0.007,0.033]
<b>Gender (ref: Male)</b>						
Female		-0.090 [-0.204,0.024]		0.044 [-0.042,0.130]		0.046 [-0.055,0.146]
<b>Age (ref: 18–24)</b>						
25–44		0.008 [-0.138,0.154]		-0.156* [-0.277,-0.036]		0.148** [0.038,0.258]
45+		-0.046 [-0.211,0.119]		-0.123 [-0.256,0.010]		0.169* [0.038,0.300]
<b>Marital status (ref: Single/divorced/widowed)</b>						
Married		-0.010 [-0.131,0.110]		0.110* [0.016,0.205]		-0.100 [-0.200,0.000]
<b>Education (ref: Without university degree)</b>						
With university degree		0.044 [-0.085,0.173]		-0.005 [-0.091,0.081]		-0.039 [-0.157,0.078]
<b>City size (ref: &gt; one million population)</b>						
≤ one million population		-0.016 [-0.121,0.088]		-0.003 [-0.076,0.070]		0.019 [-0.073,0.111]
<b>High risk due to underlying medical condition (ref: No)</b>						
Yes		0.001 [-0.122,0.124]		0.003 [-0.078,0.083]		-0.004 [-0.114,0.106]

Significance levels: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . 95 % confidence intervals in parentheses. (1) Unadjusted model, (2) adjusted model. Adjusted model includes additional variables: gender, age, education, marital status, city size, and COVID-19-related risk factors. The dependent variable is multinomial and differentiates between three outcomes: (i) vaccinated, (ii) unvaccinated, but plan to get vaccinated and (iii) unvaccinated and does not plan to get vaccinated.

**Declaration of competing interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Data availability**

Data will be made available on request.

**Appendix A. Supplementary data**

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ypmed.2024.108143>.

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