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Original Research

The Serbian COVID-19 Stress Scale and vaccine acceptance: is there a place for COVID-19-related distress in explaining attitudes towards vaccination?



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ABSTRACT

Objectives: Previous research has shown that the COVID-19 Stress Scale (CSS), a measure assessing various dimensions of distress related to the COVID-19 pandemic, is associated with self-protective behaviours; however, it remains unknown whether this distress can be used to predict attitudes towards vaccination. The purpose of this study was to validate the Serbian CSS (Serbian-CSS) and to explore its predictive power over and above certain sociodemographic characteristics, individual difference variables (attitudes and personality) and general distress in relation to COVID-19 vaccine acceptance.

Study design: An online cross-sectional study was conducted that targeted users of different social network groups at the beginning of the public COVID-19 vaccination programme in Serbia.

Methods: A large, online study sample ($N = 3129$) provided self-reported data on COVID-19-related distress, health and sociodemographic indicators, individual difference variables and attitudes towards vaccination.

Results: The Serbian-CSS is a valid and reliable instrument that assesses six dimensions of COVID-19 distress. The strongest predictors of vaccine acceptance were attitudes towards immigrants (adjusted odds ratio [AOR] = 0.36, 95% confidence interval [CI] 0.31, 0.41), followed by education (AOR = 1.51, 95% CI 1.27, 1.88) and prepandemic mental health issues (AOR = 1.61, 95% CI 1.30, 2.01).

Conclusions: The level of distress measured by the CSS had a non-substantial contribution to vaccine acceptance, which is probably because of the mild level of distress that was observed at the time of assessment. Public health messaging that relies on the distribution of information is not sufficient to address strongly held beliefs against vaccination. The study provides a benchmark for future cross-cultural research regarding negative affective states associated with the COVID-19 pandemic.

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Introduction

A number of studies have documented that people have experienced various levels of distress during the COVID-19 pandemic.^{1–3} Taylor et al. conceptualised pandemic-related distress as a multifaceted phenomenon, consisting of a set of interconnected worries, including: fear of becoming infected, fear of being in contact with contaminated objects and surfaces, socio-economic related fears, pandemic-related xenophobia, compulsive checking and

reassurance seeking regarding infection, and pandemic-related traumatic stress symptoms.¹ According to Taylor et al., this set of interconnected symptoms constitutes the COVID-19 stress syndrome, which can be measured using the COVID-19 Stress Scale (CSS).^{1,4} The CSS has been shown to perform well in different cultural and language contexts, such as Persian, Arabic and Spanish.^{5–8} Some validation studies have supported the five-factor model of the CSS, which was used for the original English version, whereas other studies have found evidence for a six-factor model, which was initially proposed for the original English version.^{5,7,8}

COVID-19-related distress as measured by the CSS has several important correlates, including higher general distress (depression and anxiety), higher avoidance behaviours and poorer coping behaviours.^{1,9} COVID-19-related distress has also been linked to

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antiscientific beliefs about the nature of SARS-CoV-2 via the belief that the COVID-19 threat is exaggerated, which raises the possibility that COVID-19-related distress measured by the CSS could be associated with attitudes towards vaccination.⁹ At the time that the first CSS validation study was carried out in America and Canada, COVID-19 vaccines were not available.⁴ The present study was conducted in Serbia a few weeks after the public COVID-19 vaccination programme had commenced, which allowed for the examination of the relation between COVID-19-related distress and vaccine acceptance/rejection within the context of an available vaccination.

At present, there is great interest in understanding the various factors contributing to COVID-19 vaccine acceptance/rejection to inform health messaging campaigns around the world. To date, certain key factors have been identified: namely, (1) sociodemographic variables; (2) personality traits, political attitudes and various beliefs; and (3) actual (state) levels of negative emotions, such as fear and worries.^{10–16} To the best of our knowledge, none of the cited studies examined the predictive power of sociodemographic and psychological (both trait and state) variables within the single study to understand the potential differences between individuals who accept and those who reject the COVID-19 vaccine.

The present study had several aims. First, we wanted to explore the reliability, validity and factor structure of the Serbian-CSS, 10 months into the pandemic and shortly after the COVID-19 vaccination programme had commenced in Serbia. Second, we examined whether COVID-19-related distress measured by the Serbian-CSS could predict vaccine acceptance, over and above sociodemographic variables (sex, age, employment and education), previous mental health issues and relatively stable individual difference characteristics (attitudes towards immigrants and intolerance of uncertainty [IU]). The selection of sociodemographic and attitudinal variables was guided by previous studies.^{11–14} IU has been identified as an important trait-like factor that may affect behaviour, including vaccination, while facing the threat of infection.¹⁷ IU is defined as an inability to endure uncertain situations and the emotional reactions provoked by the perceptions of uncertainty.¹⁸ Finally, not every type of distress experienced during the pandemic seems to be related to vaccination attitudes;¹⁰ therefore, we wanted to explore whether vaccine acceptance was limited to distress related to the perception of a particular threat (e.g. the SARS-CoV-2 virus) or whether vaccine acceptance was also related to general distress.

Methods

Sample and data collection procedure

Data were collected during the last week of January 2021 using an online LimeSurvey, which coincided with the beginning of the third wave of the pandemic and the start of the public COVID-19 vaccination programme in Serbia.¹⁹ Participants were recruited via an invitation that targeted users of various internet social networks and Facebook groups. This was the pilot section of a larger epidemiological study (Grant No. #7528289, Science Fund of the Republic of Serbia, www.CoV2Soul.rs; [Clinicaltrials.gov](https://clinicaltrials.gov) NCT 04896983). The final study population consisted of 3129 individuals who provided complete information; 281 individuals were excluded as multivariate outliers. The average age was 26.9 years (standard deviation [SD] = 7.9), and 66% of participants were females. At the time of the study, 44% of participants were

unemployed. In total, 40% had middle-school education or lower, and 60% had a Bachelor's degree (BA) level of education or higher.

Measures

Vaccination acceptance was measured via one question: 'If you haven't already been vaccinated, do you plan to receive the vaccine when it becomes available?'. The response options were 'yes', 'no' and 'not certain'. The response option 'yes' was coded 1 (for vaccination acceptance), whereas 'no' and 'not certain' were combined into a single category that was coded 0 (for both vaccination resistance and hesitation).

Data on health-related indicators were obtained by asking participants if they had previously (i.e. before the pandemic) searched for professional help due to mental health issues (1 = 'yes' and 0 = 'no'). Additional binary questions included whether the participants or their close family/friends had been infected by the SARS-CoV-2 virus and whether they had received the vaccine.

Sociodemographic characteristics included age, sex, pre-pandemic mental health problems (1 = 'yes' and 0 = 'no'), education level (the response options elementary, middle, BA, MA and PhD were recoded as 1 = 'BA and higher' and 0 = 'less than a BA') and employment status ('What is your work status?'; 1 = 'employed' and 0 = 'unemployed').

The CSS⁴ has been translated into Serbian in accordance with the recommendations of the World Health Organisation.²⁰ In English, the CSS contains five subscales (although the authors initially proposed six subscales) that measure the following COVID-19 fears: danger and contamination fears; COVID-19-related xenophobia; socio-economic fears; compulsive checking and reassurance seeking; and traumatic stress symptoms. The response options range from 0 to 4. In the present study, the alpha reliability for the total score was 0.94.

For assessment of general distress (not specifically related to the COVID-19 pandemic), the Patient Health Questionnaire-4 (PHQ-4) was used. PHQ-4 is an ultrashort screening tool for the detection of the core symptoms of depression and generalised anxiety disorder within the past 2 weeks (a 4-point scale from 0 ['not at all'] to 3 ['nearly every day'],²¹ with cut-off points of normal [0–2], mild [3–5], moderate [6–8] and severe [9–12] distress). In the present study, alpha internal consistency for the total PHQ-4 was 0.89.

The Xenophobia scale (XE) and the Intolerance of Uncertainty-11 scale (IUS-11) were used to validate the Serbian-CSS.^{22,23} XE is a four-item scale that assesses negative attitudes towards immigrants. Responses are given on a 4-point scale from 1 ('don't agree at all') to 4 ('agree completely'). Alpha reliability was 0.84. The IUS-11 assesses trait-like inability to endure uncertain and ambiguous situations and emotional reactions provoked by the perceptions of uncertainty.²⁴ Responses are recorded on a 5-point scale. Alpha reliability was 0.93.

Statistical analyses

The study population was randomly split into derivation (N = 1423) and cross-validation samples (N = 1425). Exploratory factor analysis (EFA) was conducted using maximum likelihood estimation with Oblimin rotation in SPSS 23 software.²⁵ In the cross-validation sample, a confirmatory factor analysis (CFA) was conducted to examine replicability of the EFA solution using MPlus.²⁶ Diagonally weighted least squares estimator was used to account for multivariate non-normality (Mardia's coefficients were

460.27 and 291.13).²⁷ The following standards in estimation of model fit were used: Comparative Fit Index (CFI >0.95), Tucker–Lewis index (TLI >0.90) and the Root Mean Square Error of Approximation (RMSEA ≤0.06).^{28,29} We followed Cohen's rule of thumb in interpreting correlations and regarded all correlations <0.10 as trivial.³⁰ To identify predictors of vaccine acceptance, logistic regression was performed on the total sample of unvaccinated participants with the predictors entered in three blocks in the following order: sociodemographic variables, individual difference variables (attitudes and personality) and distress measures. To facilitate interpretation, we converted odds ratios for each individual predictor into Cohen's f statistics with the values of 0.1, 0.25 and 0.4 suggesting small, medium and large effects, respectively.³⁰

Results

Description of the sample

At the time of the study, only 1% (n = 27) of participants were vaccinated. Among those who were unvaccinated, only 26% (n = 757) endorsed vaccine acceptance. Nearly half of the study sample (46%, n = 1305) reported that they personally or someone close to them had tested positive for COVID-19. Before the pandemic, 18% (n = 506) of respondents indicated that they had experienced different mental health problems; however, 62% (n = 1749) of participants reported that they had noticed a worsening of their mental health since the beginning of the pandemic.

Table 1
Exploratory factor analysis: factor loadings of the Serbian COVID-19 Stress Scale (Serbian-CSS)^a.

Items	Domain	I (C)	II (T)	III (XE)	IV (SE)	V (D)	VI (CH)
1. I am worried about catching the virus.	D					0.43	
2. I am worried that I can't keep my family safe from the virus.	D					0.54	
3. I am worried that our healthcare system won't be able to protect my loved ones.	D					0.74	
4. I am worried out healthcare system won't be able to keep me safe from the virus.	D					0.73	
5. I am worried that basic hygiene (e.g., hand-washing) is not enough to keep me safe from the virus.	D					0.63	
6. I am worried that social distancing is not enough to keep me safe from the virus.	D					0.56	
7. I am worried about grocery stores running out of food.	SE				0.79		
8. I am worried that grocery stores will close down.	SE				0.78		
9. I am worried about grocery stores running out of cleaning and disinfectant supplies.	SE				0.68		
10. I am worried about grocery stores running out of cold and flu remedies.	SE				0.61		
11. I am worried about grocery stores running out of water.	SE				0.70		
12. I am worried about pharmacies running out of prescription medicines.	SE				0.51		
13. I am worried that foreigners are spreading the virus in my country.	X			0.67			
14. If I went to a restaurant that specialized in foreign foods, I'd be worried about catching the virus.	X			0.41			
15. I am worried about coming into contact with foreigners because they might have the virus.	X			0.92			
16. If I met a person from a foreign country, I'd be worried that they might have the virus.	X			0.86			
17. If I was in an elevator with a group of foreigners, I'd be worried that they are infected with the virus.	X			0.66			
18. I am worried that foreigners are spreading the virus because they're not clean as we are.	X			0.60			
19. I am worried if I touched something in a public place (e.g. handrail, door handle), I would catch the virus.	C	0.50					
20. I am worried if someone coughed or sneezed near me, I would catch the virus.	C	0.37					
21. I am worried that people around me will infect me with the virus.	C					0.33	
22. I am worried about taking change in cash transactions.	C	0.94					
23. I am worried that I might catch the virus from handling money or using a debit machine.	C	0.98					
24. I am worried that my mail has been contaminated by mail handlers.	C	0.70					
25. I had trouble concentrating because I kept thinking about the virus.	T		0.71				
26. Disturbing mental images about the virus popped into my mind against my will.	T		0.86				
27. I had trouble sleeping because I worried about the virus.	T		0.81				
28. I thought about the virus when I did not mean to.	T		0.64				
29. Reminders of the virus caused me to have physical reactions, such as sweating or a pounding heart.	T		0.80				
30. I had bad dreams about the virus.	T		0.56				
31. Searched the Internet for treatments for COVID-19.	CH						0.78
32. Asked health professionals (e.g., doctors or pharmacists) for advice about COVID-19	CH						0.55
33. Checked YouTube videos about COVID-19.	CH						0.56
34. Checked your own body for signs of infection (e.g., taking your temperature).	CH						0.51
35. Sought reassurance from friends and family about COVID-19.	CH		0.37				0.40
36. Checked social media post concerning COVID-19.	CH						0.61

C, contamination; T, traumatic stress; XE, xenophobia; SE, socio-economic consequences; D, danger; CH, compulsive checking.

^a Loadings >0.30 are displayed.

Regarding general distress, less than half of the sample reported normal scores (34%, n = 968), mild symptoms were observed in 31% (n = 863), and moderate and severe levels were registered in 18% (n = 493) and 17% (n = 490), respectively.

Factor validity of the Serbian-CSS scale

Parallel analysis and a Scree test pointed towards a 6-factor solution, with the corresponding eigenvalues 11.26 (contamination), 3.25 (traumatic stress), 2.98 (xenophobia), 2.00 (socio-economic consequences), 1.57 (danger), and 1.42 (compulsive checking). The solution explained 62.43% of the variance. Factor loadings are presented in Table 1. As can be seen, all items were good estimates of their respective factors with two caveats: (1) item 21 had a substantial loading on the danger factor rather than the contamination factor, as would have been expected; and (2) item 35 had comparable loadings on the Traumatic Stress and Compulsive Checking factors, which was

Table 2
Goodness-of-fit indicators for the 5- and 6-factor models^a.

Model	Chi ²	Sig.	RMSEA	TLI	CFI
6-factor	2388.84	0.000	0.045–0.049	0.971	0.973
5-factor	2791.10	0.000	0.050–0.054	0.964	0.968

CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation; TLI, Tucker–Lewis index.

^a Both models estimated the correlated errors between the following items: 3 and 4, 5 and 6, 7 and 8, 10 and 12, 20 and 21, 22 and 23, 22 and 24, 23 and 24, 31 and 32, 33 and 36. See Table 1 for list of items.

Table 3
Correlations between the COVID-19 Stress Scale (CSS) subscales in derivation and cross-validation samples and alpha reliabilities^a.

Factors		1	2	3	4	5	6	Alpha
Derivation sample								
1	D	–						0.83
2	SE	0.34	–					0.86
3	X	0.39	0.28	–				0.88
4	C	0.58	0.34	0.58	–			0.91
5	CH	0.42	0.27	0.29	0.43	–		0.89
6	T	0.47	0.30	0.31	0.48	0.63	–	0.90
Cross-validation sample								
1	D	–						0.83
2	SE	0.34	–					0.85
3	X	0.40	0.27	–				0.88
4	C	0.60	0.27	0.59	–			0.91
5	CH	0.43	0.22	0.31	0.46	–		0.82
6	T	0.49	0.27	0.33	0.50	0.63	–	0.90

C, contamination; T, traumatic stress; XE, xenophobia; SE, socio-economic consequences; D, danger; CH, compulsive checking.

^a All $P < 0.001$.

also observed in a Spanish validation of the CSS.⁸ The correlations between the factors ranged from 0.20 to 0.59.

Given the difference between the original 5-factor model and the one obtained in our derivation sample, we compared these two models using CFA. Table 2 reports the goodness-of-fit indicators for the 5- and 6-factor models obtained on the cross-validation sample. It should be noted that the latent factors were defined as originally proposed by the authors of the scale, rather than using those suggested by EFA, given a possibility of sample fluctuations and measurement errors, which were not accounted for in this analysis. Both models had satisfactory fit indices, but the 6-factor model performed slightly better; hence, we opted for this model. The details can be found in the supplementary material (Table S1).

Internal consistency and validity of the Serbian-CSS

Alpha reliabilities and the correlations between the CSS subscales suggested by CFA are presented in Table 3. As can be seen, all subscales measure consistently with their constructs and have good reliability. Also, the subscales had medium to high correlations among themselves, justifying their summation and creation of a single, unit-weighted CSS score (mean = 31.95; SD = 19.00).

In both samples, the correlations between the CSS subscales and IU, as an anxiety-related trait, were within the moderate to high

Table 4
Sociodemographic, individual difference and distress variables as predictors of attitudes towards vaccination (N = 2788).

Variables	B	Wald	Sig.	AOR	95% CI	Cohen's f
Block 1						
Age	0.08	152.96	0.000	1.08	1.07 1.09	0.02
Sex (males)	0.04	0.17	0.679	1.04	0.85 1.26	0.01
Employed	−0.09	0.82	0.366	0.91	0.74 1.11	−0.03
Mental health history (yes)	0.48	18.56	0.000	1.61	1.30 2.01	0.13
Education (BA or higher)	0.43	18.94	0.000	1.51	1.27 1.88	0.11
Block 2						
Attitudes towards immigrants	−1.02	227.95	0.000	0.36	0.31 0.41	−0.28
IU	0.02	24.97	0.000	1.02	1.01 1.03	0.01
Block 3						
CSS	0.03	68.85	0.000	1.03	1.02 1.03	0.01
PHQ	−0.01	0.54	0.462	0.98	0.95 1.02	−0.01

Bolded AOR are significant at $P < 0.01$.

AOR, adjusted odds ratio; BA, Bachelor's degree; CI, confidence interval; IU, Intolerance of Uncertainty; CSS, total COVID-19 Stress Scale score; PHQ, total Patient Health Questionnaire score.

range (Table S2 in the supplementary material). Also, among the CSS subscales, only the Xenophobia subscale had small to moderate correlations with general xenophobia (i.e. the attitudes towards immigrants) in both samples, whereas the rest of the CSS subscales had non-substantial correlations with these attitudes (see Table S2).

Predictors of vaccine acceptance

In general, participants who accepted the vaccine were older (non-substantial effect), with a higher educational level (small effect) and had experienced mental health problems before the pandemic (small effect; Table 4). Sex and employment status were not significant predictors. Both individual difference variables, IU and attitudes towards immigrants, were significant predictors of vaccine acceptance. More negative attitudes towards immigrants were associated with lower vaccine acceptance (moderate effect). Higher intolerance to uncertainty was associated with vaccine acceptance (non-substantial effect). Finally, participants with higher CSS scores were more likely to accept vaccination (non-substantial effect).

Discussion

The present study demonstrates that the Serbian-CSS is a valid and reliable instrument for the assessment of six dimensions of COVID-19-related distress and possible distress associated with future pandemics. The study also demonstrates that distress measured by the Serbian-CSS is not a strong predictor of attitudes towards vaccination in comparison to the education and lifetime mental health issues. Furthermore, attitudes towards immigrants appeared to be the strongest (moderate effect) predictors of vaccine acceptance among the examined variables.

The Serbian-CSS measures six dimensions of COVID-19 distress, as originally proposed by the authors of the scale. In the present study, fear of infection and fear of contamination were split into two related but separate factors; this was also the case in the Arabic and Spanish translations of the CSS but different from Taylor et al.'s study, in which a 5-factor solution was used.^{4,7,8} It is possible that different cultural contexts and different time points during the pandemic can make some worries more salient and, consequently, more distinguishable.

The current results on the validity and reliability of the Serbian-CSS are strengthened by the fact that they were replicated in two large samples. The correlations between IU, reflecting IU and emotional reactions to uncertainty, and the CSS subscales, which are intended to incorporate various worries provoked by uncertainties that the COVID-19 pandemic elicits, are highly expected and support the validity of the Serbian-CSS. The pattern of correlations between the Serbian-CSS subscales and attitudes towards immigrants also supports the validity of the Serbian-CSS.

The present study adds to a growing body of knowledge regarding a better understanding of vaccine acceptance within the context of the COVID-19 pandemic. Compared with other European countries, where vaccine acceptance rates are between 62% and 80%, data from the present study suggest that only one-quarter of study participants expressed a willingness to be vaccinated a couple of weeks after the start of the public COVID-19 vaccination programme in Serbia.³¹ It should be noted that this study explored the attitudes and not the real vaccination behaviour of participants, which must be investigated in future studies.

Among sociodemographic characteristics, the present study supported the roles of education and previous mental health issues as meaningful predictors of attitudes towards vaccination. These variables were identified in previous studies conducted in different parts of the world, although the effects were not always consistent.

For example, some European and Australian studies did not find education to be a significant predictor of vaccine acceptance once attitudinal, political and other demographic variables were considered.^{11,13} Other studies, similar to our findings, reported that higher education was associated with a greater likelihood of vaccine acceptance within the American contexts.¹² However, even within the same cultural context (American), findings were not always consistent, suggesting a more complex, context-dependent relationship between education and vaccine acceptance.¹⁵ Similarly, context-dependent explanations can be provided for the null findings in the present study regarding sex and employment. In particular, the present study did not support the so-called gender paradox found in 10 developed countries, which suggests that women, although they are more concerned about the virus, are more likely to reject vaccination than men, probably due partly to their scepticism.³² Also, different from some studies,¹² but in agreement with others,¹³ the present study did not support the role of employment in vaccination acceptance.

Self-reports of previous mental health issues were substantially associated with a greater likelihood of vaccine acceptance, which is similar to results from a recent large Irish study.¹³ It is possible that both vaccine acceptance and reporting previous mental health issues have a common core (i.e. certain personality dispositions, such as agreeableness and/or conscientiousness) that can account for the relationship.^{13,33,34}

Regarding individual difference variables, attitudes towards immigrants were significant predictors, whereas IU did not have a substantial contribution in predicting vaccine acceptance. Similar findings have been seen by different research groups across the world; individuals who were less approving of immigrants were less likely to accept the vaccine.^{11,13} It has been documented that xenophobic attitudes increase while facing pathogen threats, including the COVID-19 virus.^{35,36} Hence, understanding the mechanisms by which these attitudes lead to health behaviours is an important area of research that requires further study. One possibility is that these attitudes are closely linked to other attitudes and beliefs, such as authoritarianism and conspiracy beliefs, forming an intertwined network of highly charged perceptions that arise from underlying fears and worldviews and motivate people to adopt these attitudes.^{37,38} Consequently, providing evidence, as a part of health campaigns to increase vaccination, is not sufficient unless these attitudinal roots are addressed.^{37,39} Vaccination campaigns could be boosted by social media platforms and their strategies to combat vaccine misinformation at the early stages.⁴⁰

Another individual difference variable considered in this study was IU. IU did not contribute to prediction of vaccination attitudes, suggesting that IU might not be relevant for the activation of pathogen threat perception and avoidance associated with it.¹⁴

The present study provided the first empirical test of the hypothesis that a certain level of distress measured by the CSS can be used to predict vaccine acceptance.⁴ Following the contributions of a certain number of sociodemographic, health and individual difference variables, the effect of the pandemic-related distress measured by the Serbian-CSS on attitudes towards vaccination was non-substantial. Before the role of distress measured by the Serbian-CSS is ruled out in explaining vaccine acceptance, it should be noted that the present study participants, on average and 10 months into the pandemic, reported only a mild level of pandemic-related distress. If pandemic distress were more pronounced, it is possible that its effect could have been more substantial. This study supports the proposition that general distress, given that it has no focus on a particular SARS-CoV-2 threat, would not be related to vaccination attitudes. In this case, the intensity of distress could not be an explanation for the null finding; namely, 35% of participants reported moderate to severe levels of general distress.

A major limitation of this study is the non-representativeness of the study sample and its focus on attitudes rather than actual behaviour. In this study, there was an oversampling of more literate and more educated individuals, females and those who were more open to searching the internet to deal with their emotional issues provoked by the COVID-19 pandemic, thus precluding generalisability. The main strength of this study is in its large sample size. To the best of our knowledge, this is the first study to examine the association of both trait and state psychological variables with attitudes towards vaccination. The association of vaccine acceptance with attitudes towards immigrants, education and previous mental health issues appears to be accurate, given that this study replicated previously reported results and extended them to the Serbian cultural contexts. The role of pandemic-related distress in explaining attitudes towards vaccinations warrants further investigation.

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Ethical approval

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Competing interests

None declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2022.01.015>.

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