ECONtribute
MARKETS & PUBLIC POLICY

**ECON**tribute
**Discussion Paper No. 197**

# The Association Between Vaccination Status Identification and Societal Polarization

Luca Henkel
Cornelia Betsch
Philipp Sprengholz
Robert Böhm
Lars Korn

September 2022

www.econtribute.de

UNIVERSITÄT BONN
Universität zu Köln

Funding by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy – EXC 2126/1-390838866 is gratefully acknowledged.

# The association between vaccination status identification and societal polarization

Luca Henkel[1 +], Philipp Sprengholz[2,3 + *], Lars Korn[2,3,4], Cornelia Betsch[2,3,4 #], and Robert Böhm[5,6,7 #]

[1] Department of Economics, University of Bonn, Germany
[2] Media and Communication Science, University of Erfurt, Germany
[3] Health Communication, Implementation Science, Bernhard Nocht Institute for Tropical Medicine, Hamburg, Germany
[4] Center for Empirical Research in Economics and Behavioral Sciences, University of Erfurt, Germany
[5] Faculty of Psychology, University of Vienna, Austria
[6] Department of Psychology, University of Copenhagen, Denmark
[7] Copenhagen Center for Social Data Science, University of Copenhagen, Denmark

+ These authors contributed equally.
# These authors jointly supervised this work.

## Abstract

Public discord between those vaccinated and those unvaccinated for COVID-19 has intensified globally. Theories of intergroup relations propose that identifying with one's social group plays a key role in the perceptions and behaviors that fuel intergroup conflict. We test whether identification with one's vaccination status is associated with current societal polarization. The study draws on panel data from samples of vaccinated (n = 3,267) and unvaccinated (n = 2,038) respondents in Germany and Austria that were collected in December 2021, February, March, and July 2022. The findings confirm that vaccination status identification (VSI) explains substantial variance in a range of polarizing attitudes and behaviors. VSI was also related to higher psychological reactance toward mandatory vaccination policies among the unvaccinated. Higher levels of VSI reduced the gap between intended and actual counter-behaviors over time by the unvaccinated. VSI appears to be an important measure for predicting behavioral responses to vaccination policies.

# Introduction

While COVID-19 vaccines have been widely available in many countries for some time, a significant proportion of people remain unvaccinated (1). As uptake slowed down despite the availability of vaccines, public discourse around the issue intensified, prompting calls for mandatory vaccination in many countries. Thousands of people have participated in public demonstrations both for and against vaccination and, more specifically, for and against associated mandates (2). As this situation is unfamiliar, little is known about what causes people to join one of these polarized camps.

How can we explain this shift from relating to one's own vaccination status as an individual and private identity to a publicly shared group identity involving collective action intentions? Some researchers have argued that individual vaccination status can become an important part of people's identity (3), and identification with these social groups has likely increased for some during the long-lasting pandemic, which has had (and continues to have) a great impact on people's lives (4, 5). Moreover, belonging to one group or the other has had real-world impacts in many countries, e.g., due to access restrictions based on vaccination status.

Research on opinion-based groups shows that social groups can form around shared attitudes (6, 7). While in the real world groups often cluster based on socio-demographic characteristics, opinion-based groups can profit especially from online interaction (8). According to social identity theory (9, 10), individuals use their group memberships to define who they are (i.e., their self-concept) and to determine what to think and how to behave. The related self-categorization theory (11) proposes that social categories are represented as a set of attributes that capture similarities within and differences between groups, including the groups' values, norms, and behaviors. In the context of vaccination and related policies, this could include, for instance, values related to belief in science, freedom to make one's own decisions, or trust in certain media. According to these prominent theoretical perspectives, people tend to view their own social groups (ingroups) as distinctive and superior to other groups (outgroups) and engage in behaviors that confirm this belief. Thus, strong group identification can fuel intergroup conflict. Such conflict may unfold in terms of how people perceive ingroup and outgroup members and how they actually behave in their interactions with ingroup and outgroup members (12). Furthermore, individuals' group identification could determine how they respond to different situations that threaten their ingroup's status (13). For example, previous research on the polarization of the American electorate has shown that partisans discriminate against opposing partisans (threatening their status) to a degree that exceeds discrimination based on race (14).

Using this strong theoretical basis, the present studies tested the fundamental idea that identification with one's vaccination status is a crucial factor in the polarization of related attitudes and behaviors. Using correlational analysis, we provide evidence on the extend of people's identification and its association with measures of societal polarization. We collected panel data from Germany and Austria ($N$ = 5,305) in three waves (December 2021, February 2022, and July 2022; plus an additional data collection with a subsample in March 2022) to investigate the correlates and consequences of what we label "vaccination status identification"

(VSI). In the total sample, 62% indicated to be vaccinated in December 2021. Compared to the adult German (GER) and Austrian (AUT) population (15–20), our sample was slightly younger ($M_{Sample}$ AUT: 44.5, $M_{Population}$ AUT = 49.6, $M_{Sample}$ GER = 47.6, $M_{Population}$ GER = 51.3), roughly balanced across genders (Sample AUT: 53.3% female, Population AUT: 51.3%; Sample GER: 53.0%, Population GER: 51.1%), more educated (Sample AUT: 48.4% have university entrance qualification, Population AUT: 44.1%; Sample GER: 53.1%, Population GER: 37.0%) and roughly similar in their likelihood to be employed (Sample AUT: 60.2%, Population AUT: 60.7%; Sample GER: 61.9%, Population GER: 58.2%). The timing of the studies is unique, as in both countries data were collected during heated public debates about the value of vaccination and different vaccination policies, such as vaccine mandates.

## Results and Discussion

### Measurement and Correlates of VSI

To measure VSI, we adapted five items from established group identification scales (e.g., "I am proud (not) to be vaccinated against COVID-19") (21, 22). The items were chosen to capture different dimensions of group identification without needing to assess a large number of items as required by established scales. Data from March 2022 showed that VSI was strongly related to other (broader or more specific) social identification measures developed by Leach et al. (23) ($r$ = .79, $CI$ = [.75, .82]) and Doosje et al. (21) ($r$ = .72, $CI$ = [.68, .76]). As further indicators of the validity of VSI, we assessed typical intergroup phenomena that should be stronger with greater identification with one's own group. Indeed, when rating the distinctiveness of the groups of vaccinated and unvaccinated people, higher levels of VSI were positively correlated with greater perceived intergroup differences for both vaccinated ($r_{vaccinated}$ = .41, $CI$ = [.30, .51]) and unvaccinated individuals ($r_{unvaccinated}$ = .29, $CI$ = [.17, .40]). In contrast (and as preregistered at https://aspredicted.org/nn2as.pdf), both groups perceived members of their respective ingroup to be more similar to each other the higher VSI was ($r_{vaccinated}$ = .59, $CI$ = [.50, .66]; $r_{unvaccinated}$ = .52, $CI$ = [.43, .61]). Outgroup members were also perceived to be more similar to each other as respondent's VSI increased, although this result was more noticeable among unvaccinated ($r_{unvaccinated}$ = .23, $CI$ = [.11, .35]) than among vaccinated respondents ($r_{vaccinated}$ = .08, $CI$ = [-.05, .20]).

Additionally, VSI proved sufficiently distinct from vaccination intention and vaccine-related feelings and beliefs. The latter were measured using the 7C scale of vaccination readiness (24), which includes confidence in vaccines, complacency, calculation, constraints, collective responsibility, compliance, and conspiracy thinking. The following correlations refer to December 2021 but did not change qualitatively in later data collection timepoints (see supplementary Table S1). Among unvaccinated individuals, correlations between VSI and the 7C ranged between -.28 (for confidence in vaccines) and .39 (for conspiracy thinking); the correlation with vaccination intention was -.26. Among vaccinated individuals, correlations between VSI and the 7C ranged between -.64 (for the perception of constraints) and .58 (for collective responsibility); the correlation with their intention to receive a booster shot was .50. Taken together, the validation results indicate that (1) VSI is indeed well described as a group

identity among the vaccinated and the unvaccinated in the context of the COVID-19 pandemic, and (2) VSI is empirically related but conceptually different from other vaccination-related perceptions and behavioral intentions.

In December 2021, mean VSI was medium to high and varied considerably between individuals, with somewhat higher overall levels among the vaccinated ($M$ = 4.74, $SD$ = 1.36) than among the unvaccinated ($M$ = 4.36, $SD$ = 1.25; $t$(4582.60) = 10.42, $p < .001$; $d$ = 0.29). Similar levels were found in February and July 2022 (see supplementary Figure S1). The (small) difference between vaccinated and unvaccinated people appears plausible given that group membership is more likely to change for the unvaccinated as they are able to change their vaccination status and, thus, their group identity. Indeed, for participants whose vaccination status did not change over time, VSI was remarkably stable (correlation between December 2021 and July 2022: $r_{\text{vaccinated}}$ = .67, $CI$ = [.65 .69]; $r_{\text{unvaccinated}}$ = .57, $CI$ = [.53, .61]). Participants who decided to get vaccinated between December 2021 and July 2022 ($n$ = 144) showed lower levels of VSI in December ($M$ = 3.81, $SD$ = 1.33) compared to unvaccinated participants who did not get vaccinated and thus did not change their group membership ($M$ = 4.51, $SD$ = 1.25; $t$(173.90) = 5.79, $p < .001$; $d$ = 0.52). Unvaccinated individuals' VSI in December 2021 was thus predictive of their subsequent likelihood of vaccine uptake—the lower their previous VSI, the higher the likelihood of getting vaccinated.

Potential predictors of VSI were explored separately for vaccinated and unvaccinated participants in December 2021 by using regression analyses including socio-demographic variables, news consumption behaviors, trust in the government, and perceptions of social norms around vaccination. Among the vaccinated, individuals were found to identify more strongly with their vaccination status when they were older ($\beta$ = 0.19, $b$ = 0.01, $CI$ = [0.01, 0.01]), trusted the government more ($\beta$ = 0.29, $b$ = 0.17, $CI$ = [0.14, 0.19]), when they reported that people important to them were vaccinated (descriptive norm to be vaccinated; $\beta$ = 0.10, $b$ = 0.09, $CI$ = [0.04, 0.14]) and, most notably, when they assumed that people important to them thought that one should be vaccinated (injunctive norm to be vaccinated; $\beta$ = 0.34, $b$ = 0.25, $CI$ = [0.20, 0.30]). VSI was also stronger among those who reported searching more frequently for COVID-19-related information ($\beta$ = 0.21, $b$ = 0.14, $CI$ = [0.11, 0.17]). Left-wing voters identified less with being vaccinated than centrists ($b$ = -0.10, $CI$ = [-0.21, 0.00]), and the same was true for right-wing voters ($b$ = -0.30, $CI$ = [-0.42, -0.12]) and nonvoters ($b$ = -0.33, $CI$ = [-0.43,-0.23]).

The unvaccinated identified more strongly with being unvaccinated when they did not perceive a descriptive norm to be vaccinated ($\beta$ = -0.14, $b$ = -0.08, $CI$ = [-0.13, -0.04]), when they trusted the government less ($\beta$ = -0.18, $b$ = -0.15, $CI$ = [-0.20, -0.09]), when they claimed to vote for right-wing parties rather than centrist parties ($b$ = 0.36, $CI$ = [0.17, 0.55]), and when they consumed less information from traditional news sources, such as TV, radio, newspapers, or government websites ($\beta$ = -0.13, $b$ = -0.46, $CI$ = [-0.67, -0.25]), and instead consumed more information from alternative sources, such as social media and messaging services ($\beta$ = 0.16, $b$ = 0.62, $CI$ = [0.40, 0.84]). Importantly, the results of both regression analyses remained qualitatively unchanged when controlling for vaccination intention and the 7C scale (see supplementary Table S2).

## Perceptions of Public Discourse and Discrimination

According to previous research (25), vaccination is perceived as a social contract. Because it has positive consequences for others, those who get vaccinated (and comply with the contract) tend to treat others who also comply more favorably than unvaccinated (non-compliant) others. Importantly, the vaccinated also tend to punish unvaccinated others (25–27), which can be interpreted as a manifestation of conflict and polarization. In line with this tendency, in December 2021, 82% of the unvaccinated perceived public discourse around vaccination as unfair, moralistic, and patronizing, while only 23% of the vaccinated reported feeling this way. Importantly, this perception was moderated by VSI (Fig. 1A); higher levels of VSI were associated with perceiving the public discourse as more positive among the vaccinated but as more negative among the unvaccinated. The results were similar for general perceptions of being discriminated against, as measured by a short five-item version of the Everyday Discrimination Scale (e.g., "Other people act as if I am not intelligent") (28). Among vaccinated individuals, average perceived discrimination was low (December 2021: $M = 1.87$, $SD = 1.22$); among the unvaccinated, it was higher ($M = 2.99$, $SD = 1.76$; $t(3259.70) = 25.23$, $p < .001$; $d = 0.74$) and increased with VSI (Fig. 1B). The same pattern was found for severe forms of discrimination measured with the Ostracism Short Scale (29) in February 2022 (e.g., "Others exclude me from conversations"). While perceived ostracism was low in both groups, unvaccinated individuals ($M = 2.03$, $SD = 1.45$) had experienced slightly more social exclusion than vaccinated participants ($M = 1.83$, $SD = 1.27$; $t(2705.90) = 4.59$, $p < .001$, $d = 0.15$). Importantly, ostracism was not related to VSI among the vaccinated but was found to be positively related among the unvaccinated (Fig. 1C).

To investigate whether perceived discrimination had any factual basis, participants were asked to play two dictator games. They were asked to distribute 100 EUR between themselves and a vaccinated person (game 1) or an unvaccinated person (game 2, randomized order). Ingroup preference was measured as the difference between the distributed amounts and indicated the strength of discrimination. The games were conducted in December 2021 and repeated in February and July 2022. At all three timepoints, the average ingroup preference of vaccinated individuals (December 2021: $M = 18.40$ EUR, $SD = 29.80$ EUR) was higher compared to unvaccinated participants ($M = 7.37$ EUR, $SD = 23.90$ EUR; $t(4981.00) = 14.86$, $p < .001$, $d = 0.41$). While vaccinated and unvaccinated individuals granted comparable amounts to ingroup members (December 2021: $M_{\text{vaccinated}} = 48.06$ EUR, $SD_{\text{vaccinated}} = 23.83$ EUR, $M_{\text{unvaccinated}} = 45.93$ EUR, $SD_{\text{unvaccinated}} = 25.11$ EUR; $t(4151.40) = 3.07$, $p = .002$, $d = .08$), vaccinated participants gave considerably less money to outgroup members than unvaccinated individuals ($M_{\text{vaccinated}} = 29.66$ EUR, $SD_{\text{vaccinated}} = 26.55$ EUR, $M_{\text{unvaccinated}} = 38.56$ EUR, $SD_{\text{unvaccinated}} = 25.30$ EUR; $t(4478.10) = 12.23$, $p < .001$, $d = .34$). Furthermore, ingroup preference among the unvaccinated increased with VSI, and this effect was even stronger among vaccinated individuals (Fig. 1D). Thus, the more vaccinated people identified with being vaccinated, the more they discriminated against unvaccinated players. The unvaccinated also did this but to a smaller extent. The stronger discrimination behavior of vaccinated individuals matches the finding that perceptions of being discriminated against were reported more frequently by unvaccinated people. This suggests that reports of discrimination are not fiction but fact.

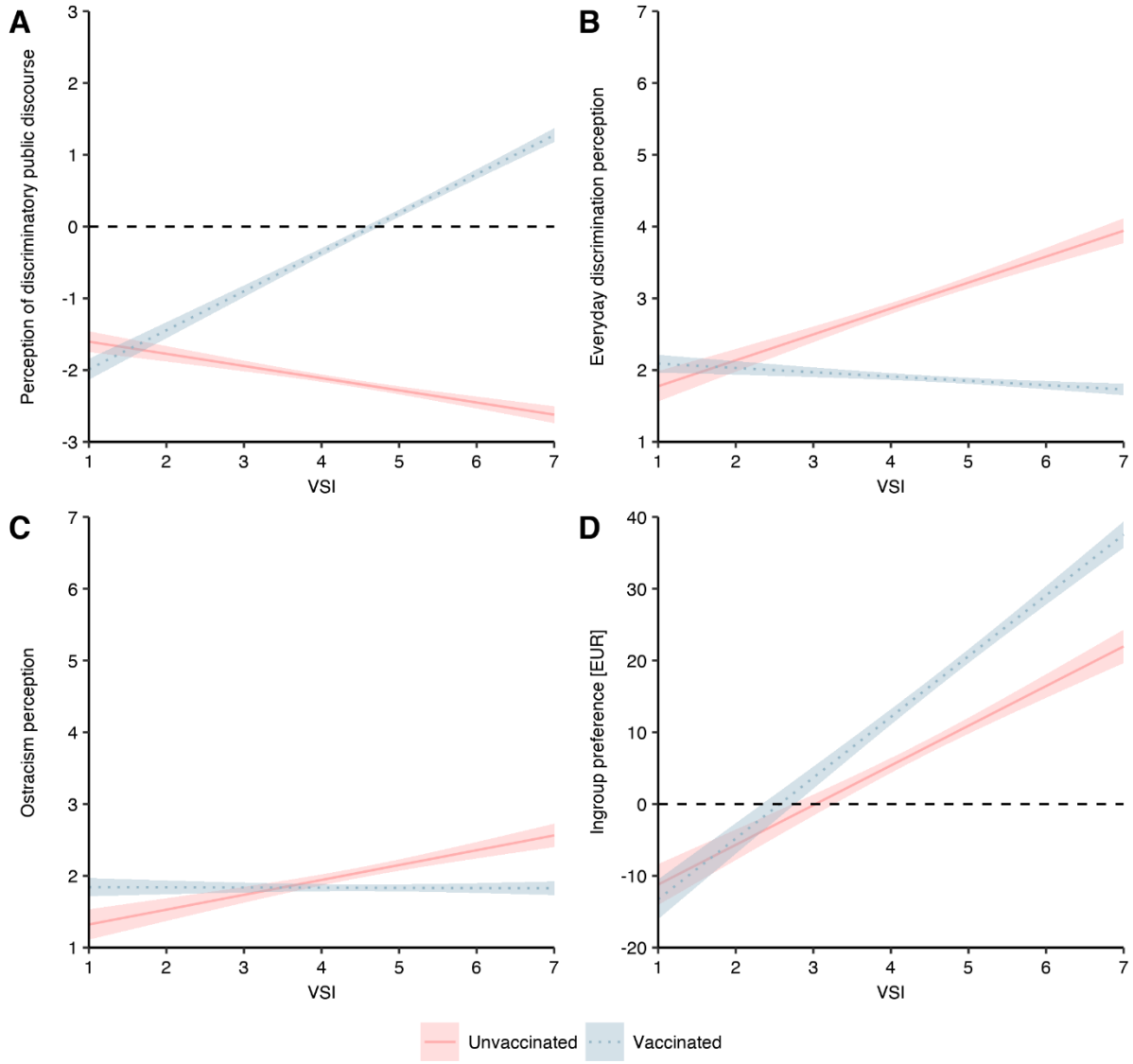


**Figure 1.** Effects of vaccination status identification (VSI) on perceptions of public discourse and discrimination

Note: Linear regression analyses of VSI, vaccination status, and their interaction, predicting (A) perceptions of public discourse (average of three 7-point scales ranging from unfair, moralistic, and patronizing to fair, objective, and respectful; data from December 2021), $R^2$ = .46; (B) perceptions of everyday discrimination (mean of five items measured on 7-point scales; higher values indicate more discrimination, data from December 2021), $R^2$ = .16; (C) perceptions of being ostracized (mean of four items measured on 7-point scales; higher values indicate being more ostracized, data from February 2022), $R^2$ = .02; (D) ingroup preference in two dictator games (positive values indicate greater ingroup preference, i.e. discrimination of the outgroup, data from December 2021), $R^2$ = .16. Lines represent the linear fit, with ribbons visualizing 95% confidence intervals. The pattern of results did not change qualitatively when controlling for sociodemographic variables and the 7C scale (see supplementary Tables S3 to S6).

## The Role of VSI in Vaccination Policy Acceptance

Previous research suggests that low vaccination intentions predict psychological reactance to mandatory vaccination policies, eliciting behaviors that oppose such regulations (30, 31). However, there are also some vaccinated people who oppose such mandates (32). To

better understand the relationship between vaccination status and reactance to mandatory vaccination, we investigated the potential moderating role of VSI. In December 2021, we conducted a between-participants experiment in which participants were asked to imagine that a vaccination mandate would be enforced in the near future. As public discussions loomed around various policy drafts in both Germany and Austria at that time, the experimental conditions took up these discussions and accordingly varied the affected age groups (mandating vaccination for people aged 12 and older vs. 18 and older) and sanctions in case of non-vaccination (fine vs. fine and work bans). Reactance was measured with a single item asking the participants how angry they were about the described mandate.

In line with previous research (30), average reactance toward mandatory vaccination was stronger for unvaccinated ($M$ = 6.53, $SD$ = 1.34) than vaccinated individuals ($M$ = 2.96, $SD$ = 2.19; $t(5301.30) = 73.75$, $p < .001$, $d$ = 1.97). Linear regression analysis revealed that the effect of vaccination status was moderated by VSI (Fig. 2A); when VSI was low (i.e., people did not identify with their vaccination status), both vaccinated and unvaccinated individuals reported high levels of reactance. When VSI was high, reactance was even greater among the unvaccinated but smaller among the vaccinated. This interaction effect was independent of the manipulated factors (mandated age group and sanctions). Reactance correlated strongly with intended behaviors opposing the mandate, including signing a petition ($r$ = .81, $CI$ = [.80, .82]), joining a demonstration ($r$ = .66, $CI$ = [.65, .68]), and mobilizing others to fight the mandate ($r$ = .67, $CI$ = [.65, .68]). This supports the view that VSI plays an important role in societal polarization as a response to vaccination policies. Higher levels of reactance were also strongly related to the intention to avoid vaccination if it became mandatory ($r$ = .76, $CI$ = [.74, .77]).
While we only assessed intentions to engage in activism against the mandate in December 2021, we explored the link between VSI and actual behavior reported in February 2022. Specifically, we asked participants whether they had participated in a demonstration or signed a petition against the introduction of vaccination mandates since the beginning of 2022. For low levels of VSI, we found that similar fractions of vaccinated and unvaccinated were involved in demonstrations (Fig. 2B) or signing petitions (Fig. 2C). However, for high levels of VSI, we found polarized behavior: the fractions strongly increased for the unvaccinated, while they decreased for vaccinated individuals. Utilizing the panel structure, we further investigated whether those individuals who indicated that they would demonstrate against mandatory vaccinations or sign a petition in December 2021 actually reported having done so in February 2022 and whether this link was influenced by VSI (as measured in December 2021). Indeed, intention was found to predict behavior ($r_{\text{demonstration}}$ = .46, $CI$ = [.43; .48]; $r_{\text{petition}}$ = .55, $CI$ = [.53, .57]). A regression analysis investigating the effects of intention, VSI, and their interaction on behaviors of unvaccinated individuals revealed that behavior was more likely when intention was high (demonstration: $\beta$ = 0.40, $b$ = 0.04, $CI$ = [0.01, 0.06]; petition: $\beta$ = 0.33, $b$ = 0.05, $CI$ = [0.01, 0.08]). The effect was moderated by VSI, with higher identification increasing the effect of intention on behavior (demonstration: $\beta$ = 0.05, $b$ = 0.01, $CI$ = [0.01, 0.01]; petition: $\beta$ = 0.05, $b$ = 0.01, $CI$ = [0.02, 0.02]).

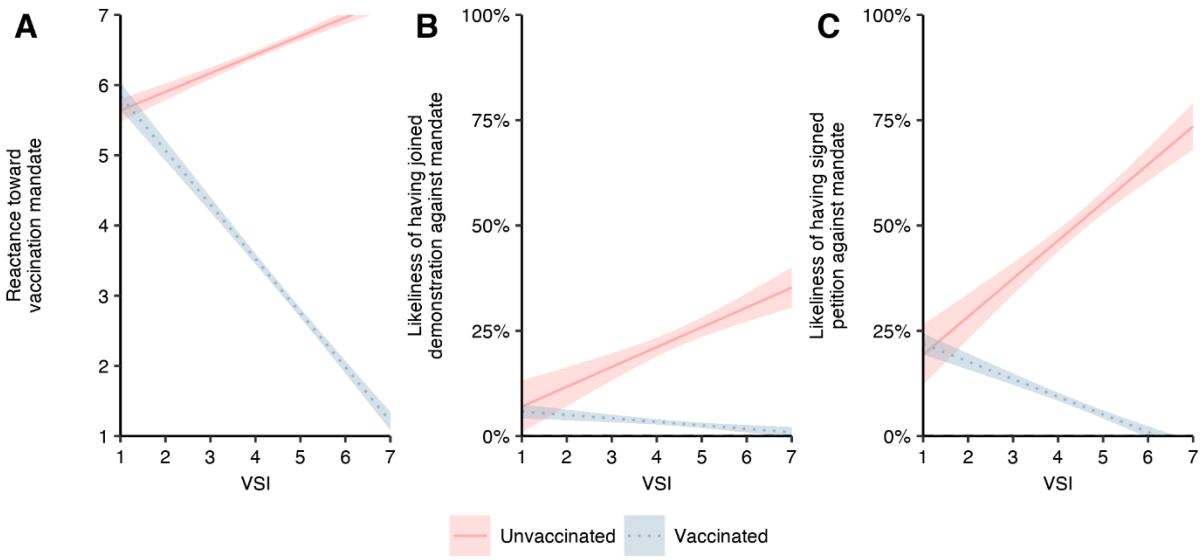


**Figure 2.** Effects of vaccination status identification (VSI) on reactance toward mandatory policies and activism behavior.

*Note:* Linear regression analyses of VSI, vaccination status, and their interaction, predicting (A) psychological reactance to a hypothetical vaccination mandate (measured by anger assessed on a 7-point scale, data from December 2021), $R^2$ = .56; (B) whether participants reported demonstrating against a vaccine mandate since January 2022 (binary variable, data from February 2022), $R^2$ = .12; (C) whether participants reported signing a petition against a vaccine mandate since January 2022 (binary variable, data from February 2022), $R^2$ = .28. The pattern of results did not change qualitatively when controlling for sociodemographic variables, the 7C, and, in the case of (A), further experimental manipulations (see supplementary Tables S7 to S9). Lines represent the linear fit, with ribbons visualizing 95% confidence intervals.

## Discussion

The findings indicate that the strength of identifying with one's vaccination status is associated with several measures of polarization of the current debate on COVID-19 vaccination. Vaccination status identification (VSI) accounts for much of the variance between vaccinated and unvaccinated individuals' perceptions of public discourse, factual and perceived discrimination, as well as the quality and strength of their responses to mandatory vaccination policies. While our results do not allow for causal interpretation, stronger VSI was associated with greater discrimination against people whose vaccination status differed. Interestingly, the tendency to discriminate was especially pronounced among vaccinated participants. This may be explained by other findings, indicating that vaccination is perceived as a social contract among vaccinated people where violating this social contract by not getting vaccinated is more harshly punished by vaccinated people than conforming to it is punished by unvaccinated people (25–27). Stronger VSI was also found to be related to higher psychological reactance to mandatory vaccination policies among the unvaccinated and to their intentions and actions to resist and evade such regulations. As VSI also related to patterns of traditional and social media use, political preferences, and differences in perceived social norms, it seems plausible that the unvaccinated and vaccinated constitute coherent and distinct social clusters ("bubbles") (33), which can be seen as a further catalyst of group conflict.

The results presented in this article have some limitations. First, the sample is not representative of the German or Austrian population. Collecting data from thousands of unvaccinated individuals meant to lift sampling requirements. While the demographics show considerable variance (see supplementary Table S10), generalization may still be limited. For instance, while similar to the German and Austrian adult population with respect to gender and employment, our sample is younger and more educated. Second, our design and analyses are correlational and causal interpretations are not possible. For instance, we cannot conclude that VSI drives discrimination; instead, the relationship could also work in the other direction or be bidirectional. Future experimental research should investigate these relationships by manipulating VSI in experimental settings. Third, all variables were self-reported and may have differed from the respondents' actual behaviors. For instance, unvaccinated participants may have exaggerated their intentions to avoid vaccination in the case of mandatory policies.

Despite these limitations, the results suggest that VSI may be important to understanding when a private and personal vaccination decision can become an important aspect of group membership that defines people's self-concept. While group processes have been assumed to be relevant when discussing anti-vaccination attitudes among anthroposophical parents (34), this study reveals strong correlates of identification with being (not) vaccinated in a general population convenience sample. The current data extend the theoretical perspective on vaccination behavior and its societal consequences and can help predict people's behaviors both within and outside of the health sector. Three key examples demonstrate this. First, unvaccinated individuals with lower levels of VSI in December 2021 were more likely to be vaccinated in July 2022. Second, unvaccinated individuals with higher levels of VSI were more likely to translate their intentions of performing counter-behaviors related to vaccination policies (e.g., attending demonstrations) into actual behaviors. Third, in unrelated money games, unvaccinated people were discriminated against by vaccinated people (and vice versa). Given the importance of these behaviors and what they represent for society in the context of the current pandemic (i.e., vaccine uptake, counter-behaviors in response to vaccination policies, and polarization), VSI appears to be a useful concept that should be considered in future research.

The findings also have practical implications. While a shared social identity is known to act as a buffer against stress from COVID-19-related threats (35), our findings highlight the potential negative consequences of strongly identifying with one's vaccination status. Besides being associated with polarization and potential conflicts between vaccinated and unvaccinated groups, VSI may also impede the success of vaccination campaigns. Appeals to identify with vaccination or a vaccinated society may thus backfire. For instance, such campaigns might increase VSI of vaccinated individuals, who potentially increase their discriminatory behavior toward unvaccinated individuals. According to previous research on rejection identification processes (36, 37), discrimination against unvaccinated people, in turn, might increase their identification with non-vaccination, lowering vaccination intentions even more and further fueling societal polarization. Talking about vaccination as a simple health intervention may be more successful. These possibilities should be explored in further research once a causal role for VSI has been established. Previous research indicates that maintaining procedural fairness, e.g., by government officials treating vaccinated and unvaccinated individuals in a fair, respectful and neutral way, can emphasize the inappropriateness of aggressive interactions and

decrease discrimination and ostracism behaviors (39). While such measures may not increase vaccination rates directly, they could help de-escalate the situation and provide a new basis for discussing and implementing effective and acceptable vaccination policies in the future. In this vein, the rationale behind vaccination mandates could be revisited in public discussions. While sanctions can increase vaccine uptake (40), mandatory regulations may also curb polarization. When individuals become vaccinated to avoid penalties, they cease to be part of the unvaccinated and their identification with this group should subsequently decrease. Similarly, and somewhat counterintuitively, we speculate that mandating vaccinations could help reduce the identification of those who have been vaccinated for a long time. Vaccination will then not be something that expresses individual preferences. And once almost all people have been vaccinated due to mandatory regulations, one will be unable to separate oneself from others with regard to vaccination status, and being vaccinated will consequently become a less important part of one's self-concept. In this way, effective (i.e., enforced) mandates could not only help to end the pandemic but also mitigate conflicts between vaccinated and unvaccinated groups, thereby fostering social cohesion.

## Methods

The present data were collected in three longitudinal waves: (1) December 15–27, 2021, (2) February 11–23, 2022, and (3) June 30-July 12, 2022. There was an additional data collection with a subsample conducted on March 14–18, 2022. During these times, infection numbers were high in Germany (with a peak of 297.845 new infections on March 18, 2022) and Austria (with a peak of 51.951 new infections at the same date), and discussions about the introduction of mandatory vaccinations loomed.

### Participants

In the first wave (December 2021), the panel included $N$ = 5,305 participants from Germany (2,003 vaccinated and 1,230 unvaccinated) and Austria (1,264 vaccinated and 808 unvaccinated). To recruit as many unvaccinated individuals as possible, sociodemographic sampling requirements were lifted. Participants were 18 to 99 years old ($M$ = 46.42, $SD$ = 16.78, with a negligible difference between the vaccinated and unvaccinated, $d$ = 0.06). 53% were female, and most participants (51%) indicated high education status (i.e., having university entrance qualifications).

In the second wave (February 2022), 4,406 of the original participants (83%) participated again (2,906 vaccinated and 1,500 unvaccinated). Between the first and second wave, 126 participants were vaccinated for the first time.

In the third wave (July 2022), 3,660 of the original participants (69%) participated again (2,442 vaccinated and 1,218 unvaccinated). Between the second and third wave, further 18 participants were vaccinated for the first time.

In an additional data collection (March 2022), a randomly selected subset of 600 participants from the second wave was invited to participate in order to validate the VSI measure. In total, 498 participated, with 249 being vaccinated and 249 unvaccinated at the time of data collection.

## Ethical Compliance

The study was conducted in accordance with German Psychological Association guidelines. Ethical clearance was obtained from the University of Erfurt's institutional review board (#20211215) and all participants provided informed consent to use and share their data for scientific purposes without disclosure of their identities. Participants were compensated for their participation by the panel provider.

## Materials and Measures

For all materials and survey questions, participants were told that being vaccinated referred to having received at least one dose of an approved COVID-19 vaccine.

## First Wave (December 2021)

All measures were assessed in the order of appearance.

**Voting preferences.** Participants were asked which political party best represents them. Depending on the country, participants could choose a party from a list of German or Austrian parties or indicate that no party represents them. Based on their selection, participants were classified as left-, center-, right- or non-voters. Note that when voting preferences are considered as predictors in regression analyses, no standardized estimates are presented in this article.

**Information behavior.** Participants were asked how often they are searching for information about the coronavirus and COVID-19. Answers were recorded on a 7-point scale ranging from "never" to "very often".

Participants were also asked if they used various types of media to stay informed, including TV, radio, newspapers, news websites, governmental websites, social media (e.g., Facebook and Instagram), and messengers (e.g., WhatsApp and Telegram). Answers were recorded on binary scales ("used" or "not used").

**Trust in the government.** Participants were asked how confident they were that the federal government could handle the coronavirus properly. Answers were recorded on a 7-point scale, ranging from not at all to very much.

**7C antecedents of vaccination.** Antecedents of vaccination were measured using the short version of the 7C scale (24). It included seven statements about confidence "(I am convinced the appropriate authorities do only allow effective and safe vaccines"), complacency ("I get vaccinated because it is too risky to get infected"), constraints ("Vaccinations are so important to me that I prioritize getting vaccinated over other things"), calculation ("I only get vaccinated when the benefits clearly outweigh the risks"), collective responsibility ("I see vaccination as a collective task against the spread of diseases"), compliance ("It should be

possible to sanction people who do not follow the vaccination recommendations by health authorities"), and conspiracy beliefs ("Vaccinations cause diseases and allergies that are more serious than the diseases they ought to protect us from"). Participants were asked about their agreement on a 7-point scale ranging from "very strongly disagree" to "very strongly agree".

**Vaccination intention.** If the participants were unvaccinated, they were asked how likely they would be to get vaccinated if they had the chance to do so next week. If the participants were already vaccinated, they were asked how likely they would be to get a booster shot if it was available and recommended to them. Intentions were recorded on a 7-point scale, ranging from "not getting vaccinated at all" to "definitively getting vaccinated".

**Social norms.** Participants were asked about descriptive and injunctive vaccination norms using two items: "People who are important to me are vaccinated, and People who are important to me think one should be vaccinated". Answers were recorded on a 7-point scale ranging from "nobody" to "everybody".

**Perception of the public discourse.** Participants were asked how they perceived the public discourse around vaccination using three 7-point items (1 to 7) with the poles unfair–fair, moralistic–objective, and patronizing–respectful. Answers were mean-averaged, and scores below 3 were considered negative perceptions, while scores above 5 were considered positive perceptions.

**Discrimination perceptions.** General discrimination perceptions were assessed using the Everyday Discrimination Scale (Cronbach's $\alpha = .90$) (28). Participants were asked to indicate their agreement with five statements (e.g., "Other people act as if I am not intelligent"). Answers were recorded on a 7-point scale ranging from "very strongly disagree" to "very strongly agree".

**VSI.** Vaccination status identification was measured with five items adapted from established group identification scales (21–23): (1) "I am proud (not) to be vaccinated against COVID-19"; (2) "When people are criticized for (not) being vaccinated against COVID-19, it feels like a personal insult to me"; (3) "I have little in common with people who have (not) been vaccinated against COVID-19" (reverse-coded); (4) "I have no problem telling others that I have (not) been vaccinated against COVID-19"; and (5) "If I learned that another person had (not) been vaccinated against COVID-19, I would directly feel more connected to that person". Answers were recorded on a 7-point scale ranging from "very strongly disagree" to "very strongly agree". We explicitly decided for creating a new measure to capture different dimensions of group identification without the need to assess a large number of items as required by established scales like the social identification scale by Leach et al. (22, 23). While internal consistency was acceptable (December 2021: Cronbach's $\alpha = .68$), the scale was also successfully validated against other identification measures in an additional wave in March 2022 (see below).

**Ingroup preference in dictator games.** Participants were asked to distribute 100 EUR between themselves and a vaccinated person (game 1) or an unvaccinated person (game 2, randomized order). The games were incentivized by the random selection of one decision by one participant for payout (in case the participant had assigned money to another person, this person was also selected randomly). Ingroup preference was measured as the difference between the amounts distributed to ingroup members and outgroup members.

**Experiment on vaccination mandates.** Participants were asked to imagine that a vaccination mandate would soon be enforced. Depending on the experimental condition, the mandate referred to different age groups (12 and older vs. 18 and older) and entailed different sanctions (fine vs. fine and work ban), resulting in a 2 × 2 between-subjects design. Participants were allocated randomly ($n_{12 \text{ and older + fine}} = 1{,}320$, $n_{18 \text{ and older + fine}} = 1{,}346$, $n_{12 \text{ and older + fine and work ban}} = 1{,}294$, $n_{18 \text{ and older + fine and work ban}} = 1{,}345$).

After receiving the information, participants were asked how much they supported the presented regulation and how angry they were about it (on a 7-point scale ranging from "not at all" to "very much"). The latter item was adapted from the Salzburg State Reactance Scale (41).

Furthermore, activism and avoidance intentions were assessed by asking participants if they would join a demonstration against the mandate, if they would sign a petition against it, if they would mobilize others to fight the regulation, and if they would try to search for ways around the mandate. Answers to these four items were collected on a 7-point scale ranging from "not at all" to "definitively".

Finally, unvaccinated participants were asked if they would get vaccinated if the presented regulation came into force. Vaccination intentions were recorded on a 7-point scale ranging from "not getting vaccinated at all" to "definitively getting vaccinated".

**Second wave (February 2022)**

In the second wave, the measures from the first wave were assessed again, except for specific media usage and the experiment on vaccination mandates. Furthermore, ostracism experiences and activism behaviors were surveyed.

**Ostracism experiences.** Using the Ostracism Short Scale (29), participants were asked how often they had experienced different forms of ostracism during the last two months (Cronbach's $\alpha = 0.93$; e.g., "Others exclude me from conversations"). Answers were recorded on a 7-point scale ranging from "never" to "always".

**Activism behavior.** Participants were asked if they had participated in a demonstration and if they had signed a petition against vaccination mandates since the beginning of 2022. The answers to both items were recorded on a binary scale ("yes" or "no").

### Third wave (July 2022)

In the third wave, the measures from the first wave were assessed again, except for the experiment on vaccination mandates.

### Additional wave with subsample (March 2022)

In this additional wave, a subsample of vaccinated and unvaccinated participants from the second wave was surveyed to validate the VSI measure (assessed as in the first and second waves) against the following identification scales.

**Social identification scales.** Participants were asked to indicate their agreement with 15 items of a social identification scale adapted from Leach et al. (22, 23); example items: (“Not) being vaccinated against COVID-19 is an important part of how I see myself”; “I am a typical person who is (not) vaccinated against COVID-19”. Answers were recorded on a 7-point scale ranging from “very strongly disagree” to “very strongly agree” (Cronbach’s $\alpha$ = .95).

Participants were also asked to indicate their agreement with four items adapted from the social identification scale developed by Doosje et al. (21); example items: “I consider myself a member of the group that has (not) been vaccinated against COVID-19”; “I identify with the group that has (not) been vaccinated against COVID-19”. Answers were recorded on a 7-point scale ranging from “very strongly disagree” to “very strongly agree” (Cronbach’s $\alpha$ = .96).

**Perceived intergroup similarity.** Participants were asked how similar they perceived the groups of vaccinated and unvaccinated people by selecting one of five figures showing two circles (representing the two groups) that had an overlap of 0–100%. Answers were coded from 1 to 5, with higher values indicating more intergroup similarity.

**Perceived intragroup similarity.** Using two items, participants were asked “How similar to each other are individuals that are (not) vaccinated against COVID-19”? Answers were recorded on a 7-point scale ranging from “not at all” to “very much”.

## Data Availability

Materials and data are available at https://dx.doi.org/10.17605/OSF.IO/6K4CW

## Code Availability

The data analysis script (including reported and supplemental analyses) is available at https://dx.doi.org/10.17605/OSF.IO/6K4CW

## Acknowledgements

Financial support for this study was provided in part by grants from University of Erfurt and Thüringer Staatskanzlei (awarded to Cornelia Betsch) and the University of Vienna (awarded to Robert Böhm) as well as the German Research Foundation (DFG, BE BE3970/11-1). Luca Henkel: Funding by the German Research Foundation under Germany´s Excellence Strategy (EXC 2126/1–390838866) is gratefully acknowledged. The funders had no role in study design, data collection and analysis, decision to publish or preparation of the manuscript.

## Author Contributions Statement

LH, PS, LK, CB and RB designed the research; LH and PS performed the research, planned and performed data analysis; LH and PS wrote the initial draft, which was revised and approved by LK, CB, and RB.

## Competing Interests Statement

The authors declare no competing interests.

## References

1. S. Mallapaty, Researchers fear growing COVID vaccine hesitancy in developing nations. *Nature* **601**, 174–175 (2022).
2. DW, Thousands protest COVID curbs in Europe amid omicron surge (2022).
3. K. Attwell, D. T. Smith, Parenting as politics: social identity theory and vaccine hesitant communities. *Int. J. Heal. Gov.* **22**, 183–198 (2017).
4. J. R. H. Wakefield, A. Khauser, Doing it for us: Community identification predicts willingness to receive a COVID-19 vaccination via perceived sense of duty to the community. *J. Community Appl. Soc. Psychol.* **31**, 603–614 (2021).
5. M. Motta, T. Callaghan, S. Sylvester, K. Lunz-Trujillo, Identifying the prevalence, correlates, and policy consequences of anti-vaccine social identity. *Polit. Groups, Identities*, 1–15 (2021).
6. A.-M. Bliuc, C. McGarty, K. Reynolds, D. Muntele, Opinion-based group membership as a predictor of commitment to political action. *Eur. J. Soc. Psychol.* **37**, 19–32 (2007).
7. C. McGarty, A.-M. Bliuc, E. F. Thomas, R. Bongiorno, Collective Action as the Material Expression of Opinion-Based Group Membership. *J. Soc. Issues* **65**, 839–857 (2009).
8. D. Garcia, V. Galaz, S. Daume, EATLancet vs yes2meat: the digital backlash to the planetary health diet. *Lancet* **394**, 2153–2154 (2019).
9. H. Tajfel, J. C. Turner, "An Integrative Theory of Intergroup Conflict." in *The Social Psychology of Intergroup Relations*, S. Worchel, W. G. Austin, Eds. (Brooks/Cole, 1979), pp. 33–47.
10. J. C. Turner, K. J. Reynolds, "The Social Identity Perspective in Intergroup Relations: Theories, Themes and Controversies." in *Blackwell Handbook of Social Psychology: Intergroup Processes*, R. Brown, S. Gaertner, Eds. (Wiley-Blackwell, 2008).
11. J. C. Turner, K. J. Reynolds, "Self-Categorization Theory" in *Handbook of Theories of*

*Social Psychology*, (SAGE Publications Ltd), pp. 399–417.
12. M. B. Brewer, "Ingroup identification and intergroup conflict: When does ingroup love become outgroup hate?" in *Social Identity, Intergroup Conflict, and Conflict Reduction*, R. D. Ashmore, L. Jussim, D. Wilder, Eds. (Oxford University Press, 2001), pp. 17–41.
13. K. R. Morrison, N. J. Fast, O. Ybarra, Group status, perceptions of threat, and support for social inequality. *J. Exp. Soc. Psychol.* **45**, 204–210 (2009).
14. S. Iyengar, S. J. Westwood, Fear and Loathing across Party Lines: New Evidence on Group Polarization. *Am. J. Pol. Sci.* **59**, 690–707 (2015).
15. Statistisches Bundesamt, Tabelle 12411-0013: Bevölkerung: Bundesländer, Stichtag, Geschlecht, Altersjahre (2022) (July 10, 2022).
16. Statistisches Bundesamt, Tabelle 12211-0100: Bevölkerung ab 15 Jahren in Hauptwohnsitzhaushalten: Deutschland, Jahre, Geschlecht, Altersgruppen, Allgemeine Schulausbildung (2022) (July 10, 2022).
17. Statistisches Bundesamt, Tabelle 12211-0001: Bevölkerung, Erwerbstätige, Erwerbslose, Erwerbspersonen, Nichterwerbspersonen aus Hauptwohnsitzhaushalten: Deutschland, Jahre, Geschlecht, Altersgruppen (2022) (July 10, 2022).
18. Bundesanstalt Statistik Österreich, Tabelle: Bevölkerung zu Jahresbeginn nach Bundesland, Alter, Geschlecht sowie österreichischer/ausländischer Staatsangehörigkeit 2002 bis 2022 (2022) (July 10, 2022).
19. Bundesanstalt Statistik Österreich, Tabelle: Erwerbstätigkeit (2022) (July 10, 2022).
20. Bundesanstalt Statistik Österreich, Tabelle: Bildungsstand der Bevölkerung 2020 ab 15 Jahren (2022) (July 10, 2022).
21. B. Doosje, N. Ellemers, R. Spears, Perceived Intragroup Variability as a Function of Group Status and Identification. *J. Exp. Soc. Psychol.* **31**, 410–436 (1995).
22. J. Roth, A. Mazziotta, Adaptation and Validation of a German Multidimensional and Multicomponent Measure of Social Identification. *Soc. Psychol. (Gott).* **46**, 277–290 (2015).
23. C. W. Leach, *et al.*, Group-level self-definition and self-investment: A hierarchical (multicomponent) model of in-group identification. *J. Pers. Soc. Psychol.* **95**, 144–165 (2008).
24. M. Geiger, *et al.*, Measuring the 7Cs of Vaccination Readiness. *Eur. J. Psychol. Assess.*, 1–9 (2021).
25. L. Korn, R. Böhm, N. W. Meier, C. Betsch, Vaccination as a social contract. *Proc. Natl. Acad. Sci.* **117**, 14890–14899 (2020).
26. O. Weisel, Vaccination as a social contract: The case of COVID-19 and US political partisanship. *Proc. Natl. Acad. Sci.* **118** (2021).
27. A. Bor, F. J. Jørgensen, M. B. Petersen, Prejudice Against the Vaccinated and the Unvaccinated During the COVID-19 Pandemic: A Global Conjoint Experiment. *PsyArXiv* (2022) https:/doi.org/10.31234/osf.io/t2g45.
28. M. J. Sternthal, N. Slopen, D. R. Williams, Racial Disparities in Health. *Du Bois Rev. Soc. Sci. Res. Race* **8**, 95–113 (2011).
29. S. C. Rudert, M. D. Keller, A. H. Hales, M. Walker, R. Greifeneder, Who gets ostracized? A personality perspective on risk and protective factors of ostracism. *J. Pers. Soc. Psychol.* **118**, 1247–1268 (2020).
30. P. Sprengholz, C. Betsch, R. Böhm, Reactance revisited: Consequences of mandatory and scarce vaccination in the case of COVID-19. *Appl. Psychol. Heal. Well-Being* (2021) https:/doi.org/10.1111/aphw.12285.
31. K. Schmelz, S. Bowles, Opposition to voluntary and mandated COVID-19 vaccination as a dynamic process: Evidence and policy implications of changing beliefs. *Proc.*

*Natl. Acad. Sci.* **119** (2022).
32. P. Sprengholz, *et al.*, Attitude toward a mandatory COVID-19 vaccination policy and its determinants: Evidence from serial cross-sectional surveys conducted throughout the pandemic in Germany. *Vaccine* (2022) https:/doi.org/10.1016/j.vaccine.2022.01.065.
33. A. L. Schmidt, F. Zollo, A. Scala, C. Betsch, W. Quattrociocchi, Polarization of the vaccination debate on Facebook. *Vaccine* **36**, 3606–3612 (2018).
34. E. J. Sobo, Social Cultivation of Vaccine Refusal and Delay among Waldorf (Steiner) School Parents. *Med. Anthropol. Q.* **29**, 381–399 (2015).
35. S. C. Rudert, *et al.*, Us and the Virus. *Eur. Psychol.* **26**, 259–271 (2021).
36. N. R. Branscombe, M. T. Schmitt, R. D. Harvey, Perceiving pervasive discrimination among African Americans: Implications for group identification and well-being. *J. Pers. Soc. Psychol.* **77**, 135–149 (1999).
37. M. R. Ramos, C. Cassidy, S. Reicher, S. A. Haslam, A longitudinal investigation of the rejection-identification hypothesis. *Br. J. Soc. Psychol.* **51**, 642–660 (2012).
38. R. Böhm, H. Rusch, J. Baron, The psychology of intergroup conflict: A review of theories and measures. *J. Econ. Behav. Organ.* **178**, 947–962 (2020).
39. M. M. Gerber, *et al.*, On the justification of intergroup violence: The roles of procedural justice, police legitimacy, and group identity in attitudes toward violence among indigenous people. *Psychol. Violence* **8**, 379–389 (2018).
40. C. Lee, J. L. Robinson, Systematic review of the effect of immunization mandates on uptake of routine childhood immunizations. *J. Infect.* **72**, 659–666 (2016).
41. S. Sittenthaler, E. Traut-Mattausch, C. Steindl, E. Jonas, Salzburger State Reactance Scale (SSR Scale). *Z. Psychol.* **223**, 257–266 (2015).

Supplementary information

# The association between vaccination status identification and societal polarization

**Table S1.** Correlations between vaccination status identification (VSI), vaccination intention and the 7C antecedents of vaccination.

| **December 2021, vaccinated participants** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| (1) Confidence | 1.00 | -0.51 | -0.59 | -0.13 | 0.68 | 0.48 | -0.47 | 0.59 | 0.53 |
| (2) Complacency | -0.51 | 1.00 | 0.61 | 0.14 | -0.61 | -0.44 | 0.32 | -0.56 | -0.52 |
| (3) Constraints | -0.59 | 0.61 | 1.00 | 0.17 | -0.64 | -0.53 | 0.33 | -0.57 | -0.64 |
| (4) Calculation | -0.13 | 0.14 | 0.17 | 1.00 | -0.18 | -0.15 | 0.22 | -0.20 | -0.16 |
| (5) Collective responsibility | 0.68 | -0.61 | -0.64 | -0.18 | 1.00 | 0.57 | -0.49 | 0.66 | 0.58 |
| (6) Compliance | 0.48 | -0.44 | -0.53 | -0.15 | 0.57 | 1.00 | -0.27 | 0.44 | 0.56 |
| (7) Conspiracy thinking | -0.47 | 0.32 | 0.33 | 0.22 | -0.49 | -0.27 | 1.00 | -0.51 | -0.30 |
| (8) Booster intention | 0.59 | -0.56 | -0.57 | -0.20 | 0.66 | 0.44 | -0.51 | 1.00 | 0.50 |
| (9) VSI | 0.53 | -0.52 | -0.64 | -0.16 | 0.58 | 0.56 | -0.30 | 0.50 | 1.00 |
| **December 2021, unvaccinated participants** | | | | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| (1) Confidence | 1.00 | -0.47 | -0.56 | 0.13 | 0.60 | 0.46 | -0.39 | 0.51 | -0.28 |
| (2) Complacency | -0.47 | 1.00 | 0.61 | -0.15 | -0.57 | -0.47 | 0.23 | -0.58 | 0.24 |
| (3) Constraints | -0.56 | 0.61 | 1.00 | -0.06 | -0.64 | -0.66 | 0.23 | -0.63 | 0.21 |
| (4) Calculation | 0.13 | -0.15 | -0.06 | 1.00 | 0.14 | 0.04 | -0.04 | 0.13 | -0.12 |
| (5) Collective responsibility | 0.60 | -0.57 | -0.64 | 0.14 | 1.00 | 0.52 | -0.31 | 0.59 | -0.26 |
| (6) Compliance | 0.46 | -0.47 | -0.66 | 0.04 | 0.52 | 1.00 | -0.14 | 0.45 | -0.14 |
| (7) Conspiracy thinking | -0.39 | 0.23 | 0.23 | -0.04 | -0.31 | -0.14 | 1.00 | -0.31 | 0.39 |
| (8) Vaccination intention | 0.51 | -0.58 | -0.63 | 0.13 | 0.59 | 0.45 | -0.31 | 1.00 | -0.26 |
| (9) VSI | -0.28 | 0.24 | 0.21 | -0.12 | -0.26 | -0.14 | 0.39 | -0.26 | 1.00 |
| **February 2022, vaccinated participants** | | | | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| (1) Confidence | 1.00 | -0.55 | -0.61 | -0.12 | 0.71 | 0.51 | -0.51 | 0.63 | 0.54 |
| (2) Complacency | -0.55 | 1.00 | 0.68 | 0.14 | -0.64 | -0.46 | 0.39 | -0.60 | -0.55 |
| (3) Constraints | -0.61 | 0.68 | 1.00 | 0.19 | -0.69 | -0.56 | 0.38 | -0.61 | -0.63 |
| (4) Calculation | -0.12 | 0.14 | 0.19 | 1.00 | -0.16 | -0.16 | 0.20 | -0.18 | -0.15 |
| (5) Collective responsibility | 0.71 | -0.64 | -0.69 | -0.16 | 1.00 | 0.57 | -0.51 | 0.65 | 0.61 |
| (6) Compliance | 0.51 | -0.46 | -0.56 | -0.16 | 0.57 | 1.00 | -0.24 | 0.48 | 0.57 |
| (7) Conspiracy thinking | -0.51 | 0.39 | 0.38 | 0.20 | -0.51 | -0.24 | 1.00 | -0.49 | -0.34 |
| (8) Booster intention | 0.63 | -0.60 | -0.61 | -0.18 | 0.65 | 0.48 | -0.49 | 1.00 | 0.52 |
| (9) VSI | 0.54 | -0.55 | -0.63 | -0.15 | 0.61 | 0.57 | -0.34 | 0.52 | 1.00 |

| **February 2022, unvaccinated participants** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| (1) Confidence | 1.00 | -0.43 | -0.45 | 0.14 | 0.55 | 0.34 | -0.40 | 0.42 | -0.30 |
| (2) Complacency | -0.43 | 1.00 | 0.64 | -0.17 | -0.58 | -0.46 | 0.22 | -0.52 | 0.19 |
| (3) Constraints | -0.45 | 0.64 | 1.00 | -0.09 | -0.62 | -0.67 | 0.21 | -0.52 | 0.18 |
| (4) Calculation | 0.14 | -0.17 | -0.09 | 1.00 | 0.16 | 0.03 | -0.07 | 0.13 | -0.11 |
| (5) Collective responsibility | 0.55 | -0.58 | -0.62 | 0.16 | 1.00 | 0.47 | -0.31 | 0.53 | -0.27 |
| (6) Compliance | 0.34 | -0.46 | -0.67 | 0.03 | 0.47 | 1.00 | -0.13 | 0.35 | -0.13 |
| (7) Conspiracy thinking | -0.40 | 0.22 | 0.21 | -0.07 | -0.31 | -0.13 | 1.00 | -0.28 | 0.43 |
| (8) Vaccination intention | 0.42 | -0.52 | -0.52 | 0.13 | 0.53 | 0.35 | -0.28 | 1.00 | -0.24 |
| (9) VSI | -0.30 | 0.19 | 0.18 | -0.11 | -0.27 | -0.13 | 0.43 | -0.24 | 1.00 |
| **July 2022, vaccinated participants** | | | | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| (1) Confidence | 1.00 | -0.59 | -0.64 | -0.16 | 0.72 | 0.47 | -0.48 | 0.66 | 0.56 |
| (2) Complacency | -0.59 | 1.00 | 0.68 | 0.17 | -0.69 | -0.47 | 0.36 | -0.66 | -0.58 |
| (3) Constraints | -0.64 | 0.68 | 1.00 | 0.23 | -0.71 | -0.57 | 0.35 | -0.67 | -0.65 |
| (4) Calculation | -0.16 | 0.17 | 0.23 | 1.00 | -0.21 | -0.13 | 0.30 | -0.24 | -0.16 |
| (5) Collective responsibility | 0.72 | -0.69 | -0.71 | -0.21 | 1.00 | 0.55 | -0.49 | 0.73 | 0.63 |
| (6) Compliance | 0.47 | -0.47 | -0.57 | -0.13 | 0.55 | 1.00 | -0.21 | 0.48 | 0.59 |
| (7) Conspiracy thinking | -0.48 | 0.36 | 0.35 | 0.30 | -0.49 | -0.21 | 1.00 | -0.50 | -0.31 |
| (8) Booster intention | 0.66 | -0.66 | -0.67 | -0.24 | 0.73 | 0.48 | -0.50 | 1.00 | 0.57 |
| (9) VSI | 0.56 | -0.58 | -0.65 | -0.16 | 0.63 | 0.59 | -0.31 | 0.57 | 1.00 |
| **July 2022, unvaccinated participants** | | | | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| (1) Confidence | 1.00 | -0.49 | -0.52 | 0.19 | 0.58 | 0.43 | -0.37 | 0.44 | -0.31 |
| (2) Complacency | -0.49 | 1.00 | 0.65 | -0.19 | -0.58 | -0.53 | 0.17 | -0.49 | 0.20 |
| (3) Constraints | -0.52 | 0.65 | 1.00 | -0.11 | -0.61 | -0.73 | 0.17 | -0.50 | 0.17 |
| (4) Calculation | 0.19 | -0.19 | -0.11 | 1.00 | 0.20 | 0.06 | -0.07 | 0.19 | -0.15 |
| (5) Collective responsibility | 0.58 | -0.58 | -0.61 | 0.20 | 1.00 | 0.53 | -0.23 | 0.55 | -0.23 |
| (6) Compliance | 0.43 | -0.53 | -0.73 | 0.06 | 0.53 | 1.00 | -0.13 | 0.38 | -0.10 |
| (7) Conspiracy thinking | -0.37 | 0.17 | 0.17 | -0.07 | -0.23 | -0.13 | 1.00 | -0.19 | 0.45 |
| (8) Vaccination intention | 0.44 | -0.49 | -0.50 | 0.19 | 0.55 | 0.38 | -0.19 | 1.00 | -0.23 |
| (9) VSI | -0.31 | 0.20 | 0.17 | -0.15 | -0.23 | -0.10 | 0.45 | -0.23 | 1.00 |

**Table S2.** Predictors of VSI.

| | Vaccinated participants | | Unvaccinated participants | |
|---|---|---|---|---|
| | Base model | Extended model | Base model | Extended model |
| Descriptive norm | 0.085*** (0.035, 0.136) | 0.040* (-0.001, 0.082) | -0.082*** (-0.126, -0.038) | -0.065*** (-0.109, -0.022) |
| Injunctive norm | 0.247*** (0.198, 0.296) | 0.065*** (0.024, 0.107) | -0.009 (-0.052, 0.034) | 0.034 (-0.009, 0.077) |
| Trust in government | 0.166*** (0.141, 0.191) | 0.058*** (0.035, 0.082) | -0.145*** (-0.198, -0.092) | -0.036 (-0.092, 0.020) |
| Frequency of news consumption | 0.137*** (0.107, 0.168) | 0.050*** (0.023, 0.078) | 0.003 (-0.032, 0.038) | 0.001 (-0.033, 0.034) |
| News: usage of classic sources | 0.098 (-0.078, 0.273) | -0.009 (-0.161, 0.144) | -0.458*** (-0.671, -0.245) | -0.260** (-0.466, -0.053) |
| News: usage of alternative sources | 0.221** (0.007, 0.435) | 0.342*** (0.159, 0.524) | 0.617*** (0.398, 0.836) | 0.328*** (0.116, 0.540) |
| Age | 0.011*** (0.008, 0.013) | 0.006*** (0.004, 0.008) | 0.000 (-0.004, 0.004) | -0.002 (-0.006, 0.002) |
| Gender: male (Baseline: female) | -0.088** (-0.164, -0.012) | -0.017 (-0.082, 0.048) | 0.082 (-0.030, 0.195) | -0.002 (-0.110, 0.105) |
| Gender: other (Baseline: female) | -0.061 (-0.668, 0.546) | 0.209 (-0.578, 0.997) | -0.140 (-0.706, 0.427) | -0.070 (-0.679, 0.539) |
| Education: 10+ years without university entrance qualification (Baseline: up to 9 years) | -0.049 (-0.172, 0.074) | -0.013 (-0.120, 0.093) | -0.066 (-0.231, 0.098) | -0.072 (-0.231, 0.088) |
| Education: 10+ years with university entrance qualification (Baseline: up to 9 years) | 0.012 (-0.110, 0.134) | 0.031 (-0.073, 0.135) | -0.208** (-0.377, -0.040) | -0.215*** (-0.377, -0.052) |
| Migration background: no (Baseline: yes) | 0.003 (-0.099, 0.106) | 0.009 (-0.080, 0.097) | 0.047 (-0.097, 0.191) | 0.069 (-0.068, 0.205) |
| Migration background: no response (Baseline: yes) | 0.038 (-0.349, 0.424) | -0.179 (-0.502, 0.144) | -0.313 (-0.973, 0.346) | -0.267 (-0.851, 0.317) |
| Household income: middle (Baseline: low) | 0.021 (-0.086, 0.128) | 0.034 (-0.060, 0.127) | -0.141** (-0.280, -0.003) | -0.137** (-0.268, -0.006) |
| Household income: high (Baseline: low) | -0.063 (-0.174, 0.047) | -0.046 (-0.142, 0.049) | -0.061 (-0.210, 0.087) | -0.075 (-0.215, 0.066) |
| Household income: no response (Baseline: low) | 0.016 (-0.128, 0.160) | -0.011 (-0.131, 0.109) | -0.104 (-0.275, 0.068) | -0.108 (-0.271, 0.054) |
| Religious: no (Baseline: yes) | -0.001 (-0.077, 0.074) | -0.009 (-0.074, 0.056) | -0.187*** (-0.294, -0.080) | -0.177*** (-0.280, -0.075) |
| Employment: no (Baseline: yes) | 0.203*** (0.106, 0.301) | 0.178*** (0.096, 0.260) | -0.072 (-0.199, 0.055) | -0.013 (-0.135, 0.109) |
| Working in health: yes (Baseline: no) | -0.074 (-0.208, 0.061) | -0.097* (-0.211, 0.017) | 0.059 (-0.136, 0.253) | 0.11 (-0.078, 0.298) |
| Working in system-relevant job: yes (Baseline: no) | -0.01 (-0.103, 0.083) | -0.036 (-0.117, 0.045) | 0.024 (-0.101, 0.148) | -0.007 (-0.125, 0.110) |

| | | | | |
|---|---|---|---|---|
| Voting preference: left (Baseline: center) | -0.104*<br>(-0.210, 0.001) | -0.078*<br>(-0.169, 0.014) | 0.045<br>(-0.202, 0.291) | 0.079<br>(-0.154, 0.312) |
| Voting preference: nonvoter (Baseline: center) | -0.331***<br>(-0.433, -0.230) | -0.271***<br>(-0.359, -0.183) | -0.025<br>(-0.208, 0.158) | -0.07<br>(-0.242, 0.101) |
| Voting preference: other (Baseline: center) | -0.293**<br>(-0.520, -0.066) | -0.073<br>(-0.245, 0.099) | 0.05<br>(-0.222, 0.322) | 0.04<br>(-0.218, 0.297) |
| Voting preference: right (Baseline: center) | -0.296***<br>(-0.415, -0.177) | -0.162***<br>(-0.266, -0.058) | 0.360***<br>(0.169, 0.552) | 0.239***<br>(0.058, 0.420) |
| Confidence | | 0.062***<br>(0.030, 0.094) | | -0.019<br>(-0.065, 0.028) |
| Complacency | | -0.039***<br>(-0.065, -0.013) | | 0.061**<br>(0.014, 0.108) |
| Constraints | | -0.175***<br>(-0.201, -0.149) | | 0<br>(-0.079, 0.080) |
| Calculation | | -0.009<br>(-0.025, 0.007) | | -0.030**<br>(-0.055, -0.006) |
| Collective responsibility | | 0.062***<br>(0.027, 0.097) | | -0.023<br>(-0.070, 0.024) |
| Ccompliance | | 0.138***<br>(0.117, 0.159) | | 0.004<br>(-0.071, 0.080) |
| Conspiracy thinking | | 0.009<br>(-0.017, 0.036) | | 0.199<br>(0.159, 0.239) |
| Vaccination intention | | | | -0.04<br>(-0.091, 0.011) |
| Constant | 1.054***<br>(0.778, 1.329) | 2.767***<br>(2.348, 3.186) | 4.976***<br>(4.526, 5.427) | 3.652***<br>(2.866, 4.438) |
| *n* | 3,267 | 3,267 | 2,038 | 2,038 |
| $R^2$ | 0.381 | 0.544 | 0.143 | 0.233 |

*Note:* Data from December 2021. 95% confidence intervals in parentheses (*p < .1, **p < .05, ***p < .01).

**Table S3.** Effect of VSI on perception of discriminatory public discourse.

| | **Model 1** | **Model 2** | **Model 3** |
|---|---|---|---|
| Includes sociodemographics | | X | X |
| Includes 7C | | | X |
| VSI | -0.170*** (-0.215, -0.124) | -0.145*** (-0.190, -0.100) | -0.066*** (-0.104,-0.028) |
| Status: vaccinated (Baseline: unvaccinated) | -1.098*** (-1.376, -0.821) | -0.990*** (-1.264, -0.715) | -0.537*** (-0.773, -0.301) |
| Interaction VSI x status | 0.713*** (0.654, 0.772) | 0.653*** (0.593, 0.713) | 0.223*** (0.158, 0.288) |
| Constant | -1.434*** (-1.646, -1.221) | -0.765*** (-1.082, -0.448) | -1.388*** (-1.829, -0.946) |
| *n* | 5,305 | 5,305 | 5,305 |
| $R^2$ | 0.458 | 0.477 | 0.556 |

*Note:* Data from December 2021. 95% confidence intervals in parentheses (*p < .1, **p < .05, ***p < .01). Sociodemographic variables include age, gender, education, migration background, household income, religion, political preference, employment status, and if participants work in healthcare or a system-relevant job.

**Table S4.** Effect of VSI on everyday discrimination perception.

| | **Model 1** | **Model 2** | **Model 3** |
|---|---|---|---|
| Includes sociodemographics | | X | X |
| Includes 7C | | | X |
| VSI | 0.361*** (0.300,0.422) | 0.364*** (0.304,0.425) | 0.264*** (0.202,0.326) |
| Status: vaccinated (Baseline: unvaccinated) | 0.736*** (0.436,1.037) | 0.327** (0.025,0.629) | 0.244 (-0.056,0.544) |
| Interaction VSI x status | -0.421*** (-0.489,-0.353) | -0.322*** (-0.392,-0.253) | -0.178*** (-0.254,-0.102) |
| Constant | 1.414*** (1.152,1.676) | 3.036*** (2.678,3.394) | 3.068*** (2.605,3.532) |
| *n* | 5,305 | 5,305 | 5,305 |
| $R^2$ | 0.158 | 0.222 | 0.283 |

*Note:* Data from December 2021. 95% confidence intervals in parentheses (*p < .1, **p < .05, ***p < .01). Sociodemographic variables include age, gender, education, migration background, household income, religion, political preference, employment status, and if participants work in healthcare or a system-relevant job.

**Table S5.** Effect of VSI on ostracism perception.

| | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Includes sociodemographics | | X | X |
| Includes 7C | | | X |
| VSI | 0.207***<br>(0.150,0.264) | 0.223***<br>(0.165,0.281) | 0.120***<br>(0.061,0.179) |
| Status: vaccinated (Baseline: unvaccinated) | 0.730***<br>(0.438,1.022) | 0.531***<br>(0.236,0.826) | 0.428***<br>(0.133,0.723) |
| Interaction VSI x status | -0.210***<br>(-0.276,-0.143) | -0.172***<br>(-0.240,-0.103) | -0.067*<br>(-0.145,0.012) |
| Constant | 1.115***<br>(0.866,1.364) | 2.655***<br>(2.292,3.018) | 2.811***<br>(2.331,3.291) |
| *n* | 4,406 | 4,406 | 4,406 |
| $R^2$ | 0.018 | 0.084 | 0.159 |

*Note:* Data from February 2022. 95% confidence intervals in parentheses (*p < .1, **p < .05, ***p < .01). Sociodemographic variables include age, gender, education, migration background, household income, religion, political preference, employment status, and if participants work in healthcare or a system-relevant job.

**Table S6.** Effect of VSI on ingroup preference [EUR]

| | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Includes sociodemographics | | X | X |
| Includes 7C | | | X |
| VSI | 5.530***<br>(4.540,6.521) | 5.352***<br>(4.347,6.357) | 5.600***<br>(4.549,6.651) |
| Status: vaccinated (Baseline: unvaccinated) | -4.987*<br>(-10.190,0.215) | -3.943<br>(-9.308,1.422) | -1.653<br>(-7.151,3.845) |
| Interaction VSI x status | 2.937***<br>(1.725,4.149) | 2.723***<br>(1.450,3.997) | 1.082<br>(-0.397,2.561) |
| Constant | -16.744***<br>(-20.848,-12.640) | -19.961***<br>(-26.167,-13.755) | -14.607***<br>(-23.829,-5.385) |
| *n* | 5,305 | 5,305 | 5,305 |
| $R^2$ | 0.162 | 0.171 | 0.182 |

*Note:* Data from December 2021. 95% confidence intervals in parentheses (*p < .1, **p < .05, ***p < .01). Sociodemographic variables include age, gender, education, migration background, household income, religion, political preference, employment status, and if participants work in healthcare or a system-relevant job.

**Table S7.** Effect of VSI on reactance toward vaccination mandate.

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Includes sociodemographics | | X | X | X |
| Includes 7C | | | X | X |
| Includes experimental manipulations | | | | X |
| VSI | 0.256***<br>(0.207, 0.323) | 0.250***<br>(0.188, 0.311) | 0.248***<br>(0.187, 0.309) | 0.071**<br>(0.015, 0127) |
| Status: vaccinated (Baseline: unvaccinated) | 1.238***<br>(0.853, 1.623) | 1.080***<br>(0.682, 1.478) | 1.066***<br>(0.667, 1.464) | 0.174<br>(-0.169, 0.518) |
| Interaction VSI x status | -1.036***<br>(-1.113, -0.960) | -0.983***<br>(-1.065, -0.902) | -0.981***<br>(-1.062, -0.899) | -0.233***<br>(0.320, -0.145) |
| Constant | 5.375***<br>(5.091, 5.659) | 5.773***<br>(5.332, 6.215) | 5.666***<br>(5.217, 6.114) | 6.037***<br>(5.432, 6.642) |
| *n* | 5,305 | 5,305 | 5,305 | 5,305 |
| $R^2$ | 0.561 | 0.568 | 0.569 | 0.679 |

*Note:* Data from December 2021. 95% confidence intervals in parentheses (*p < .1, **p < .05, ***p < .01). Sociodemographic variables include age, gender, education, migration background, household income, religion, political preference, employment status, and if participants work in healthcare or a system-relevant job.

**Table S8.** Effect of VSI on likeliness of having joined demonstration against mandate.

| | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Includes sociodemographics | | X | X |
| Includes 7C | | | X |
| VSI | 0.047***<br>(0.031, 0.063) | 0.042***<br>(0.026, 0.058) | 0.027***<br>(0.010, 0.043) |
| Status: vaccinated (Baseline: unvaccinated) | 0.044<br>(-0.033, 0.120) | 0.024<br>(-0.052, 0.100) | -0.002<br>(-0.078, 0.074) |
| Interaction VSI x status | -0.055***<br>(-0.072, -0.038) | -0.047***<br>(-0.065, -0.030) | -0.018*<br>(-0.036, 0.001) |
| Constant | 0.023<br>(-0.049, 0.095) | 0.115**<br>(0.021, 0.208) | 0.160***<br>(0.044, 0.276) |
| *n* | 4,406 | 4,406 | 4,406 |
| $R^2$ | 0.119 | 0.146 | 0.170 |

*Note:* Data from February 2022. 95% confidence intervals in parentheses (*p < .1, **p < .05, ***p < .01). Sociodemographic variables include age, gender, education, migration background, household income, religion, political preference, employment status, and if participants work in healthcare or a system-relevant job.

**Table S9.** Effect of VSI on likeliness of having signed petition against mandate.

| | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Includes sociodemographics | | X | X |
| Includes 7C | | | X |
| VSI | 0.090*** (0.071, 0.109) | 0.076*** (0.058, 0.095) | 0.050*** (0.031, 0.069) |
| Status: vaccinated (Baseline: unvaccinated) | 0.157*** (0.060, 0.255) | 0.114** (0.019, 0.209) | 0.054 (-0.039, 0.147) |
| Interaction VSI x status | -0.132*** (-0.153, -0.111) | -0.111*** (-0.132, -0.091) | -0.045*** (-0.067, -0.023) |
| Constant | 0.103** (0.016, 0.190) | 0.140** (0.031, 0.249) | 0.132* (-0.006, 0.271) |
| *n* | 4,406 | 4,406 | 4,406 |
| $R^2$ | 0.284 | 0.317 | 0.356 |

*Note:* Data from February 2022. 95% confidence intervals in parentheses (*p < .1, **p < .05, ***p < .01). Sociodemographic variables include age, gender, education, migration background, household income, religion, political preference, employment status, and if participants work in healthcare or a system-relevant job.

**Table S10.** Sociodemographics.

| | Unvaccinated | Vaccinated |
|---|---|---|
| n | 2,038 | 3,267 |
| Age | 45.9 (14.7) | 46.8 (17.9) |
| Gender | | |
| Male | 829 (40.7%) | 1639 (50.2%) |
| Female | 1198 (58.8%) | 1619 (49.6%) |
| Other | 11 (0.5%) | 9 (0.3%) |
| Education | | |
| Up to 9 years | 304 (14.9%) | 456 (14.0%) |
| 10+ years without university entrance qualification | 776 (38.1%) | 1050 (32.1%) |
| 10+ years with university entrance qualification | 958 (47.0%) | 1761 (53.9%) |
| Employment | | |
| Yes | 1305 (64.0%) | 1944 (59.5%) |
| No | 733 (36.0%) | 1323 (40.5%) |

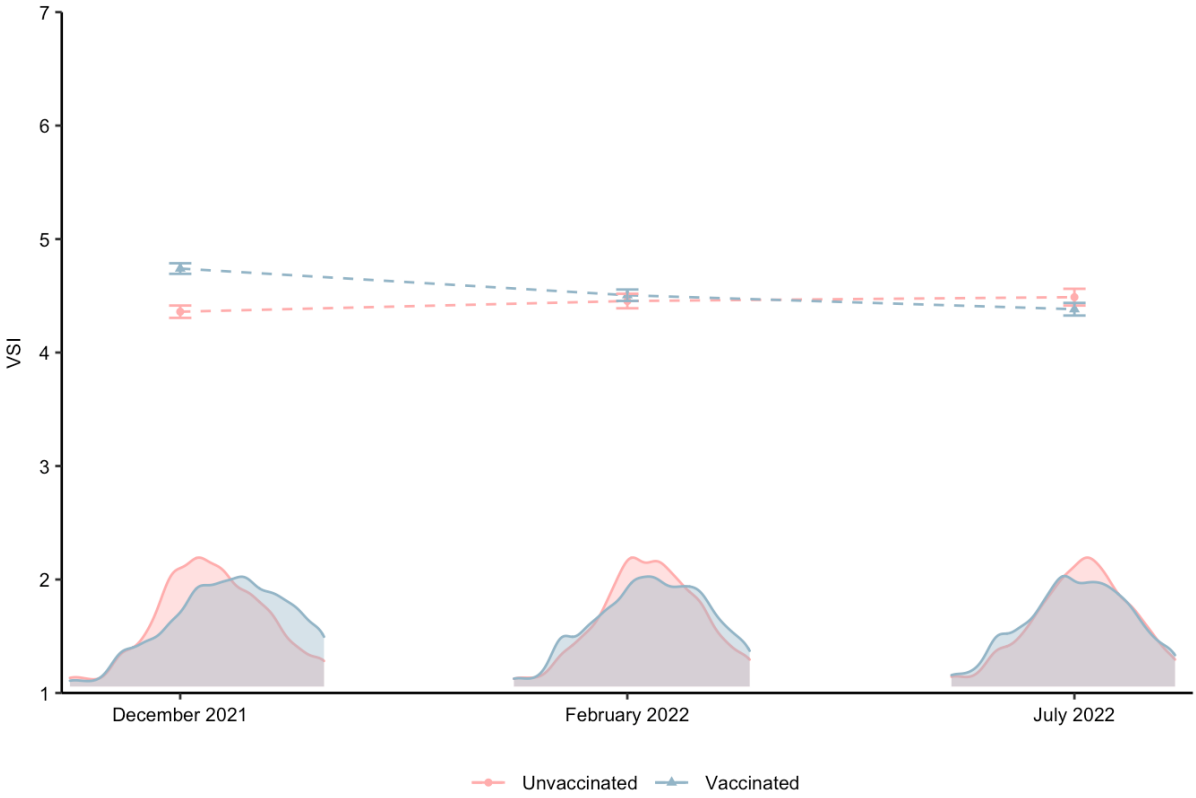


**Figure S1.** Stability of VSI over time.