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Experimental testing of three categorization-based interventions to reduce prejudice and discrimination against the unvaccinated in the aftermath of COVID-19

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Abstract

For many people, COVID-19 vaccination now informs social identity, triggering prejudice and discrimination toward those with a different vaccination status. As this may jeopardize social cohesion, we investigated the effects of three brief, theory-informed interventions for reducing ingroup bias in a preregistered experimental intervention study in Germany, assigning vaccinated participants (N = 2016) to one of four conditions: crossed categorization (emphasizing commonalities between vaccinated and unvaccinated individuals), recategorization (framing vaccinated and unvaccinated individuals as members of a superordinate ingroup), counter-stereotypic categorization (encouraging participants to think about mismatched

stereotypes), or a control condition (no intervention). As compared to the control condition, crossed categorization and counter-stereotypic categorization were found to reduce (evaluative) ingroup bias but the observed effects were weak and mostly diminished when controlling for demographic characteristics and vaccination status identification. Overall, the results indicate that none of the three interventions substantially reduced prejudice and discrimination toward the unvaccinated.

INTRODUCTION

The COVID-19 pandemic posed unprecedented challenges for public health provision. Following widespread and extended restrictions to limit the spread of the virus, many people welcomed the introduction of vaccines as a means of ending the pandemic. However, despite the availability of COVID-19 vaccines in many countries, a substantial proportion of people remain unwilling to be vaccinated (Mathieu et al., 2021), and conflict between the vaccinated and those who choose not to be vaccinated has intensified over time. These tensions became especially apparent while restrictions were in place, as both sides launched petitions and demonstrations, respectively, advocating more restrictions and mandatory vaccination for unvaccinated individuals or protesting against perceived paternalism, tutelage, and suppression (DW, 2022). While the need for restrictive measures decreased with the emergence of the Omicron variants, these two broad groups remain polarized (Henkel et al., 2023); for instance, one online poll in the US revealed that 61% of vaccinated respondents would refuse to work with an unvaccinated coworker if afforded that option (Paczka, 2022). This polarization may not only disturb individual interactions, but it may also affect cohesion, trust, and health on a societal level (Sprengholz et al., 2023b). For instance, unvaccinated individuals who face prejudice and discrimination by vaccinated individuals may suffer from decreased wellbeing, lose important relationships, surround and radicalize themselves with like-minded people and oppose future recommendations from health authorities they feel are favoring vaccinated over unvaccinated people. Recent research in the social and behavioral sciences indicates a growing interest in the dynamics of this conflict between vaccinated and unvaccinated individuals, including its underlying factors and consequences (Bor et al., 2022; Henkel et al., 2023; Korn et al., 2020; Wagner & Eberl, 2022; Weisel, 2021). Some studies have suggested that vaccination status is a salient aspect of social identity, fueling discrimination and conflict between vaccinated and unvaccinated individuals (e.g., Henkel et al., 2023). Informed by psychological theory, the present study aimed to critically assess the effectiveness of three interventions to reduce discriminatory evaluations and behaviors grounded in social categorization. It aims toward depolarizing vaccination-related identities. Our findings highlight the potential and limitations of commonly employed interventions in this novel context.

Discrimination and conflict between vaccinated and unvaccinated people

To understand what triggers the conflict between vaccinated and unvaccinated people, it is important to understand the nature of their respective decisions. While vaccination protects

the vaccinating individual, it also provides a positive externality to others, especially during a pandemic. This externality may be direct—by reducing transmission of the virus (Betsch et al., 2013; Eyre et al., 2022; Fine et al., 2011)—or indirect—by reducing severe infection and freeing healthcare resources for the treatment of infected individuals who cannot be vaccinated (e.g., immunocompromised individuals) or those suffering from other illnesses who also need treatment resources (Nyberg et al., 2022; Sprengholz et al., 2022). Individuals who choose not to be vaccinated may also profit from these externalities—for example, being able to access surgical treatment because the health system can support this. The vaccination decision poses a social dilemma; while deciding to be vaccinated incurs some costs (e.g., effort, risk of adverse reaction), refusing to be vaccinated can be interpreted as free riding on the contribution of others to public health (Böhm & Betsch, 2022; Böhm et al., 2016). As the motives for refusing vaccination are often unknown and may involve impression management, there may be a tendency to perceive unvaccinated individuals as free riders, even when there are other reasons for their decision, such as low confidence in vaccine safety and efficacy or perceived low risk following infection (Lazarus et al., 2022).

In light of this social dilemma, willful refusal to be vaccinated may be negatively perceived by vaccinated individuals, prompting punishment motives as in the case of other social dilemmas (for a meta-analysis, see Balliet et al., 2011). Even before the COVID-19 pandemic, Korn et al. (2020) advanced strong evidence that vaccinated individuals tend to discriminate against unvaccinated individuals in monetary allocation tasks (but not vice versa). This finding was conceptually verified during the pandemic (Weisel, 2021). Similarly, extending Korn et al.'s (2020) findings, Bor et al. (2022) found evidence of culturally widespread discriminatory attitudes against unvaccinated individuals, including antipathy, stereotyping, support for exclusion from family relationships, support for the removal of political rights, and discriminatory behavior. While they did not observe such attitudes in the opposite direction (i.e., unvaccinated people showing prejudice and discriminating against vaccinated people), Henkel et al. (2023) found that ongoing widespread discrimination against unvaccinated individuals during the COVID-19 pandemic also triggered reciprocal negative (although somewhat weaker) reactions during an incentivized dictator game. Importantly, the effect was moderated by vaccination status identification (VSI); that is, stronger VSI (e.g., pride in (not) being vaccinated or perceived commonality with other people who are (not) vaccinated) was associated with a greater willingness to give money to a person with the same vaccination status compared to a person with a different vaccination status. Among both vaccinated and unvaccinated individuals, average VSI levels were medium to high and stable. Higher levels of VSI were also associated with larger perceived intragroup similarities and intergroup differences, indicating that the decision to be vaccinated (or not) involves processes of social categorization.

In line with the evidence on opinion-based groups (Bliuc et al., 2007), vaccinated and unvaccinated individuals seem to form social groups around shared attitudes and motives, such as the desire to get vaccinated in the interests of communal health or the decision to avoid vaccination because of safety concerns. The resulting discriminatory behaviors align with the Social Identity Theory prediction (Tajfel & Turner, 1979) that group members strive for a positive self-concept and so tend to view their own group (ingroup) as distinctive and superior to others (outgroups). By implication, strong identification with a given vaccination status is likely to fuel conflict between vaccinated and unvaccinated individuals.

In the short term, this issue complicates pandemic responses; in the long run, it may also result in a more polarized society. Previous research suggests that prejudice and discrimination against minority groups can erode trust, both in the majority and in the state and its institutions, including health authorities (Williamson et al., 2019). As unvaccinated people can be seen to

constitute a minority group in many countries, discrimination against them may amplify mistrust and jeopardize social cohesion, with permanent adverse effects on the uptake of vaccines and other health services. In many countries, efforts to encourage unvaccinated individuals to get vaccinated against COVID-19 include education initiatives, moral appeals, incentives, and coercive measures (for instance, see Dubé et al., 2022). While there is evidence that certain interventions have had positive effects immediately after vaccination roll-out (Andreas et al., 2022), these are unlikely to increase subsequent uptake of primary vaccination, given that circulating variants and available vaccines do not change significantly (Sprengholz et al., 2023a). For that reason, interventions that seek to reduce social categorization may arguably offer more long-term public health benefits than sustained or increased pressure on unvaccinated individuals.

Interventions to reduce discrimination and conflict

In the literature on group conflict and polarization, a number of studies have proposed and tested categorization-based interventions designed to mitigate negative intergroup attitudes and behaviors. In general, these interventions aim to reduce the salience of intergroup boundaries by emphasizing commonalities between ingroup and outgroup members (Dovidio & Gaertner, 1999). In the present case, we relied on the following three approaches (Prati et al., 2021).

Crossed categorization

Individuals typically identify with more than one social group. Understanding that members of an outgroup can simultaneously belong to other ingroups has long been known to reduce ingroup-outgroup differentiation (Deschamps, 1977; Prati et al., 2021). For instance, in the case of vaccination, realizing that individuals with the opposite vaccination status share hobbies or political affiliations may prompt ingroup favoritism that outweighs outgroup prejudice and discrimination. Clearly, this depends on the existence of similarities between ingroup and outgroup members, and those similarities must be as significant as the perceived group differences (Mullen et al., 2001). In the present context, where there are strong levels of VSI, there is a risk that crossed categorization interventions may curb but not eliminate prejudice and conflict between vaccinated and unvaccinated individuals.

Recategorization

According to the Common Ingroup Identity Model (Gaertner et al., 1993), prejudice toward outgroup members diminishes when people perceive themselves as members of a more inclusive superordinate group comprising both ingroup and outgroup members. For instance, if vaccinated and unvaccinated individuals recategorize themselves as members of a society seeking to end the pandemic, intergroup prejudice and discrimination against those of the opposite vaccination status may decline. In theory, developing a superordinate identity does not require anyone to abandon their previous group identities. However, among those who exhibit strong social identification, recategorization may pose a perceived threat to group distinctiveness, motivating increased outgroup discrimination (Crisp et al., 2006; van Leeuwen et al., 2003). As both vaccinated and unvaccinated individuals commonly exhibit high levels of VSI, it is unclear whether they can be expected to form a common or superordinate group.

Counter-stereotypic categorization

While both crossed categorization and recategorization can help to reduce prejudice against specific outgroups, these strategies do not promote more general tolerance. There is some evidence that encouraging people to think about individuals who do not fit existing stereotypes (e.g., male midwives, Harvard-educated plumbers) can prompt a temporary cognitive shift from heuristic thinking to processing of individuating characteristics (Crisp & Turner, 2011). To that extent, mindset manipulation interventions that focus on counter-stereotypic categorization can reduce prejudice against multiple outgroups (Vasiljevic & Crisp, 2013). This form of intervention might also help to improve attitudes and behaviors toward people with a different vaccination status.

Overview

To determine whether brief interventions based on the above theory- and evidence-based approaches might help to reduce vaccination status-related prejudice and discrimination, we conducted an online experiment involving German participants ($N = 2016$). In light of existing evidence that vaccinated individuals are more likely to discriminate against unvaccinated individuals than vice versa (Bor et al., 2022; Henkel et al., 2023), only vaccinated people were included here.

Participants were assigned to one of four conditions (Table 1). Those in the *crossed categorization* condition read a short text that claimed there were more similarities than differences between vaccinated and unvaccinated individuals. After reading the text, participants were asked to list three such similarities. In the *recategorization* condition, participants read a short text emphasizing that all Germans helped to bring the pandemic under control and that the country's success in doing so may reflect German deliberateness and welfare orientation. After reading the text, participants were asked to provide an example of how Germans work together to ensure their common welfare. In the *counter-stereotypic categorization* condition, participants read a short text about surprising combinations of social categories (e.g., a rich student). They were then asked to identify five such combinations from their own experience. Participants in the *control* condition received no text or task.

Following the experimental manipulation, our analysis assessed each participant on two outcome measures. First, we measured *evaluative ingroup bias as* the extent to which a participant favored vaccinated individuals on evaluative attributes like intelligence, benevolence, and egoism. Second, we assessed *behavioral ingroup bias* as the extent to which participants were willing to allocate more money to vaccinated than unvaccinated individuals during two incentivized dictator games. For each of the three intervention conditions, we hypothesized that participants would exhibit less evaluative ingroup bias and less behavioral ingroup bias than those in the control condition. We also investigated potential process variables, including perceived similarity of the vaccinated and unvaccinated and perceived homogeneity within these groups. As VSI has been shown to influence discrimination against those with a different vaccination status (Henkel et al., 2023), we also explored the moderating effect of VSI on process and outcome variables.

METHOD

Participants and design

The online experiment was designed as a one-factorial between-participant study with four conditions (crossed categorization vs. recategorization vs. counter-stereotypic categorization vs.

TABLE 1 Intervention texts and tasks.

Crossed categorization	Recategorization	Counter-stereotypic categorization
Although differences between the vaccinated and the unvaccinated are often emphasized, both groups are similar in many ways.	Please read the following newspaper commentary carefully:	We would like you to think about social groups in general.
Vaccinated and unvaccinated individuals can be found in every age group and profession. Both groups share similar hopes (e.g., that the pandemic will end soon) and concerns (e.g., that society is becoming more selfish).	All in all, we Germans have come through the pandemic well, probably because of our level-headed nature. Unlike the citizens of other countries, we all strive for the common good and try to reconcile everyone's interests. Of course, disputes can sometimes arise, but we Germans are forgiving and long-term thinkers. By pulling together, we can master the great challenges of our time.	People may belong to many different social groups or categories (e.g., *wife, student, brother, soccer player, rich, smart, funny, etc.*).
What similarities can you think of between the vaccinated and the unvaccinated? Please give three examples.	Now please provide an example that shows how we Germans stick together and work for the good of all.	Please list below five group membership pairs that seem not to go together—that is, two group affiliations that you might be surprised to find in the same person (e.g., *rich student*).

Note: Control group participants were not provided with a text or task.

control). Based on a priori power calculation using G*Power, we sought to recruit 2000 vaccinated participants, using linear regression to detect small effects of the different conditions on ingroup bias ($f = .075$, $\alpha = .05$, $1-\beta = .80$). In total, 2016 German participants completed the experiment during the period January 11–16, 2023. The sample was non-probabilistic but quota-representative for age × gender. Participants ranged in age from 18 to 74 years ($M = 45.95$, $SD = 15.44$). The sample included 1001 males and 1015 females. Participants were somewhat better educated than the general public as 57% reported having university entrance qualification. Comparison of political orientations further showed that among participants willing to vote, less were favoring the right-wing populist party *AfD* (9%) than observed in a representative survey from the same month (15%; Infratest Dimap, 2023). Sociodemographic characteristics were broadly similar across all conditions (see online supplement). All participants confirmed that they had received at least one vaccination against COVID-19.

Ethics and open science

The study complied with German Psychological Association guidelines. Ethical clearance was obtained from the University of Erfurt's institutional review board (#20220525), and all participants provided informed consent to use and share their data for scientific purposes without identity disclosure. Participants were compensated for their participation by the panel provider.

The study design, hypotheses, sample size, and analyses were preregistered (https://aspredicted.org/4q4uf.pdf). The online supplement provides open access to the study materials, data, and analyses codes (https://osf.io/hzp8k/). In the following, all measures, conditions, and data exclusions are reported.

Materials and measures

Before the experiment, we assessed participants' attention and VSI. Process variables and evaluative and behavioral ingroup biases were measured afterward. Original measures and materials can be found in the online supplement, they were ordered as detailed below.

Attention check

Participants were asked about their opinion on the annual clock changes between summer and winter time, recording their answers in a text field. Only 39% of answers complied with the communicated (and preregistered) quality criterion of writing at least 15 words (the remaining 61% were coded as lazy) but 94% of answers were accepted as valid replies to the question (the remaining 6% were coded as inattentive; two raters achieved a moderate inter-rater reliability of $\kappa = .71$; conflicting ratings were resolved by discussion). For instance, a short but valid reply like "unnecessary" or "it's ok" was coded as lazy but not inattentive.

VSI

To measure VSI, we used five items adapted from established group identification scales: (1) I am proud to be vaccinated against COVID-19; (2) When people are criticized for 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; (4) I have no problem telling others that I have been vaccinated against COVID-19; (5) If I learned that another person had been vaccinated

against COVID-19, I would immediately feel more connected to that person. Answers were recorded on a 7-point scale ranging from very strongly disagree to very strongly agree and mean averaged (Cronbach's $\alpha = .73$). For more information on scale validity, see Henkel et al. (2023).

Experimental manipulation

Participants were randomly assigned to one of the experimental conditions. Compared to participants in the control condition, those assigned to the intervention conditions had to read a short text and complete a task before continuing (Table 1).

Process variables

Participants were asked to indicate how similar they perceived the two groups (vaccinated and unvaccinated) to be by selecting one of five figures. Each figure showed two circles (representing the two groups) overlapping to various degrees from 0% to 100%. Answers were coded 1–5; higher values indicated greater overlap (i.e., more intergroup similarity). They were also asked to rate ingroup and outgroup homogeneity by answering the question *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*.

Evaluative ingroup bias

Participants were asked to evaluate the extent to which vaccinated and unvaccinated people exhibit six attributes: *competence, intelligence, likability, benevolence, egoism*, and *fairness*. Answers were again recorded on a 7-point scale ranging from *does not apply at all* to *applies very much*. After inverting egoism scores, answers were mean-averaged for both vaccinated (Cronbach's $\alpha = .85$) and unvaccinated groups (Cronbach's $\alpha = .89$). For each participant, evaluative ingroup bias was calculated as the difference between mean-averaged ingroup and outgroup attributions.

Behavioral ingroup bias

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

RESULTS

Vaccination status identification (VSI)

On average, participants identified strongly with being vaccinated ($M = 4.36$, $SD = 1.34$), aligning with findings from previous studies (Henkel et al., 2023).

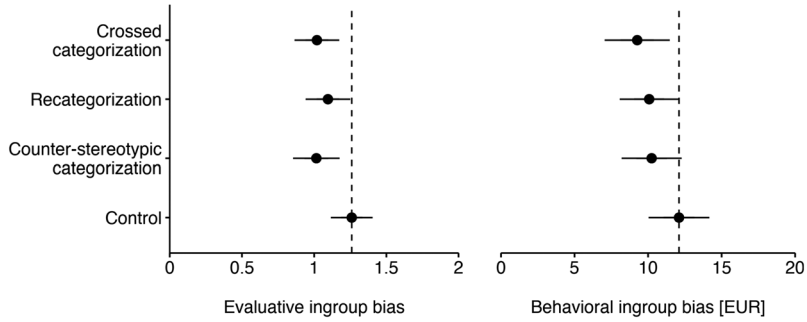

FIGURE 1 Evaluative and behavioral ingroup bias by experimental condition (mean values, 95% confidence intervals). *Note*: Both bias indicators were regressed on experimental condition to test for significant effects, using the control group as reference. Evaluative ingroup bias was reduced among those in the crossed categorization and counter-stereotypic categorization conditions, but no intervention achieved a significant reduction in behavioral ingroup bias. The significant main effects of experimental condition on evaluative ingroup bias did not persist after controlling for age, gender, VSI, and interactions with experimental condition.

Evaluative ingroup bias

Strong internal consistency among the six evaluative attributions supported the calculation of mean evaluation scores. On average, vaccinated individuals were evaluated as more positive ($M = 4.66$, $SD = 1.08$) than unvaccinated individuals ($M = 3.56$, $SD = 1.24$, $d = .95$). To investigate whether this difference—representing evaluative ingroup bias—was dependent on experimental condition, it was regressed on this variable, using the control group as reference. As shown in Figure 1 (left panel), participants assigned to the crossed categorization ($b = -.24$, $SE = .11$, *95% CI* $= [-.45, -.03]$) and counter-stereotypic categorization conditions ($b = -.24$, $SE = .11$, *95% CI* $= [-.46, -.03]$) exhibited less evaluative ingroup bias than control group participants. However, participants in the recategorization condition exhibited no significant reduction ($b = -.16$, $SE = .11$, *95% CI* $= [-.38, .05]$). There was no qualitative change in the results on excluding inattentive participants (6%) who failed to provide an appropriate answer to the preliminary question about clock changes (see online supplement for details). Note that the preregistered intention to exclude lazy participants was dropped, as this would have removed more than half of participants from the analyses.

To investigate whether the impacts of the three interventions differed by participant age, gender, school education, political orientation, or VSI, the main and interaction effects of these potential moderators were examined in another explorative regression predicting average evaluative ingroup bias. In general, increasing age ($b = .01$, $SE = .00$, *95% CI* $= [.01, .02]$) and stronger VSI ($b = .60$, $SE = .05$, *95% CI* $= [.50, .70]$) were linked to stronger evaluative ingroup bias. However, no further main effects were observed for the interventions. There was just one interaction effect between intervention and education; recategorization increased bias among participants who completed at least 10 years of school but never obtained university entrance qualification (compared to individuals who only spent up to 9 years in school, $b = .90$, $SE = .37$, *95% CI* $= [.17, 1.62]$), see online supplement for the complete regression results.

Behavioral ingroup bias

In the two dictator games, participants allocated significantly more money to vaccinated individuals ($M = 45.66$ EUR, $SD = 23.03$ EUR) than to the unvaccinated ($M = 35.22$ EUR, $SD = 25.73$ EUR,

$d = .43$). The difference—representing behavioral ingroup bias—was regressed on experimental condition to investigate the effects of the three interventions, using the control condition as reference. As shown in Figure 1 (right panel), all interventions tended to decrease bias. However, none of these changes were significant, although for participants in the crossed categorization condition, the bias reduction approached statistical significance ($b = -2.84$ EUR, $SE = 1.48$ EUR, *95% CI* = [−5.74 EUR, .06 EUR]). There was no qualitative change in the results on excluding inattentive or lazy participants (see online supplement).

When age, gender, school education, political orientation, VSI, and their interactions with experimental condition were added to the regression, the two known main effects from the analysis of evaluative ingroup bias were observed again. Stronger behavioral ingroup bias was associated with increasing age ($b = .13$ EUR, $SE = .06$ EUR, *95% CI* = [.00 EUR, .25 EUR]) and stronger VSI ($b = 5.46$ EUR, $SE = .74$ EUR, *95% CI* = [4.00 EUR, 6.92 EUR]). Voters of left (*Die Linke*; $b = 10.54$ EUR, $SE = 4.70$ EUR, *95% CI* = [1.32 EUR, 19.76 EUR]) and other minor parties ($b = 13.15$ EUR, $SE = 4.84$ EUR, *95% CI* = [3.65 EUR, 22.64 EUR]) exhibited stronger bias (compared to individuals who did not state their voting preference). Some interaction effects were found as well. While recategorization again increased bias for participants who completed at least 10 years of school but never obtained university entrance qualification (compared to individuals who only spent up to 9 years in school, $b = 13.72$ EUR, $SE = 5.43$ EUR, *95% CI* = [3.08 EUR, 24.36 EUR]), crossed-categorization reduced bias for voters of conservative (*CDU/CSU*; $b = -11.79$ EUR, $SE = 5.31$ EUR, *95% CI* = [−22.21 EUR, −1.38 EUR]), left-wing (*Die Linke*; $b = -14.83$ EUR, $SE = 7.00$ EUR, *95% CI* = [−28.57 EUR, −1.09 EUR]) and other minor parties ($b = -18.29$, $SE = 6.81$, *95% CI* = [−31.65, −4.93]), compared to individuals who did not state their voting preference (see online supplement for the complete regression results).

Process variables

Participants perceived little intergroup similarity between the vaccinated and the unvaccinated ($M = 2.76$, $SD = 1.32$). No experimental intervention had a significant effect on this perception (see online supplement). Perceived (ingroup) homogeneity of the vaccinated was medium to high ($M = 4.61$, $SD = 1.54$) and did not vary significantly across experimental conditions (see online supplement). Perceived (outgroup) homogeneity of the unvaccinated was largely comparable to perceived ingroup homogeneity ($M = 4.43$, $SD = 1.65$, $d = .11$). However, perceived outgroup homogeneity was dependent on experimental condition; compared to the control group, outgroup homogeneity was perceived as stronger for crossed categorization ($b = .40$, $SE = .10$, *95% CI* = [.20, .60]), recategorization ($b = .31$, $SE = .10$, *95% CI* = [.11, .51]), and counter-stereotypic categorization ($b = .31$, $SE = .10$, *95% CI* = [.11, .51]). For all process variables, there was no qualitative change in the pattern of results when excluding inattentional or lazy participants.

DISCUSSION

In many countries, vaccination status has become an important element of people's identity. In line with Social Identity Theory (Tajfel & Turner, 1979), ingroup favoritism has led to the societal polarization of vaccinated and unvaccinated groups, accompanied by mutual prejudice and discrimination (Bor et al., 2022; Henkel et al., 2023). In this study, we investigated the potential of three categorization-based interventions to reduce prejudice and discrimination of vaccinated toward unvaccinated people: crossed categorization (emphasizing commonalities between vaccinated and unvaccinated individuals), recategorization (framing vaccinated and unvaccinated

individuals as members of a superordinate prosocial community pursuing common goals), and counter-stereotypic categorization (encouraging people to think about mismatched stereotypes). Crossed categorization and counter-stereotypic categorization seemed to achieve a slight reduction in evaluative ingroup bias, and crossed categorization also resulted in a somewhat reduced behavioral ingroup bias. However, the observed effects were weak and diminished when controlling for demographic characteristics and vaccination status identification (VSI), with one exception; crossed categorization reduced evaluative ingroup bias among women (but not men).

Overall, our findings suggest that none of the three interventions was able to reduce prejudice and discrimination to a substantive degree. If any, crossed categorization seems the most promising approach. Further research should assess how best to promote the perception of similarities between vaccinated and unvaccinated individuals. Possible strategies for amplifying the effects of crossed categorization might include providing more elaborate stories of positive relationships between vaccinated and unvaccinated individuals or realizing real experiences of similarity.

We can only speculate on the ineffectiveness of the other two interventions. In the case of recategorization, strong levels of VSI may have inhibited perception of a common superordinate ingroup (Crisp et al., 2006; van Leeuwen et al., 2003). Furthermore, such a perception would not necessarily mean abandoning membership of an existing ingroup or any accompanying prejudice and discrimination. The negligible effects of counter-stereotypic categorization on ingroup bias may reflect its more abstract and temporary nature; even if information processing shifted from stereotypic to individuating information during the intervention phase, it may not have sustained to reduce prejudice afterwards.

Interestingly, all three interventions strengthened perceptions of outgroup homogeneity, which may explain their failure to impact ingroup bias. As the vaccinated participants in our study identified strongly with their vaccination status, being asked to focus on commonalities with unvaccinated individuals is likely to threaten their social identity (Crisp et al., 2006; van Leeuwen et al., 2003). This threat may be overcome by perceiving the unvaccinated as a more homogenous group of people, *all* of whom differ to a similar extent from oneself and one's own ingroup. In other words, categorization-based interventions may trigger rationalization processes that amplify the perception of distinct homogenous groups and thereby counteract the intended reduction of ingroup bias.

While the impacts of categorization interventions seem limited, two other findings may contribute to the reduction of prejudice and discrimination in the future. First, we found that increasing age was associated with stronger evaluative and behavioral ingroup bias. While this is understandable in light of the increased risks for older adults of severe COVID-19 infection (Yek et al., 2022), this finding suggests that measures to reduce societal polarization should especially focus on older age groups. For instance, a crossed categorization intervention that highlights similarities between vaccinated and unvaccinated individuals might usefully introduce examples that refer to older adults and their common goals, values, and problems.

Second, we identified VSI as the main predictor of evaluative and behavioral ingroup bias. To reduce prejudice and discrimination, future interventions might focus more on reducing identification with one's own vaccination status than on amplifying perceived similarities between ingroup and outgroup members. This could be achieved by emphasizing ingroup heterogeneity—for instance, by communicating people's different reasons for getting vaccinated. If vaccinated individuals realized that many members of their ingroup had decided to be vaccinated for purely egoistic or practical rather than prosocial reasons (e.g., because they needed a vaccination certificate for work), ingroup identification and bias might diminish. This seems a useful direction for future research.

Strong identification with being vaccinated may be grounded in a sense of what is morally right (Korn et al., 2020). From a pro-vaccination perspective, unvaccinated individuals may be seen as free riders who profit from the positive externalities of vaccination without contributing to them. Over the course of the pandemic, these externalities included a desire to protect others by helping to reduce pathogen transmission or severe infections that capture extensive healthcare resources. In future debates, communicators should be aware that stressing these issues and moralizing about vaccination decisions may serve only to increase identification and the consequent potential for polarization.

We can hope that group identification might decrease naturally over time as the need diminishes for restrictive measures against COVID-19 and differences based on vaccination status become less salient or meaningful. However, most societies will inevitably reflect on the pandemic, assessing the response, the costs, and the damage done to education, health, and society itself. Previous research shows that vaccination status will undoubtedly influence this evaluation (Sprengholz et al., 2023b), and therefore it is unlikely that the polarization will vanish automatically. In conclusion, effective strategies to address it are needed. If tensions persist between the vaccinated and the unvaccinated, this will pose risks for social cohesion, trust, and long-term uptake of healthcare resources beyond vaccination against COVID-19. However, the present findings suggest that categorization-based communication approaches are very limited in their ability to reduce prejudice and discrimination and may even prove detrimental by making outgroups seem more homogenous.

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CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILAILABILITY STATEMENT

Original study materials, data, analyses, and codes are available at https://osf.io/hzp8k/?view_only=3c276764f1e247b188912e4700119d74 [link will be replaced with DOI upon publication]

OPEN RESEARCH BADGES

This article has earned Open Data, Open Materials and Preregistration badges. Data are available at https://dx.doi.org/10.17605/OSF.IO/HZP8K, materials are available at https://dx.doi.org/10.17605/OSF.IO/HZP8K and preregistration is available at https://aspredicted.org/4q4uf.pdf).

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