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Morality of vaccination: the influence of moral conviction on vaccination decisions

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ABSTRACT

Vaccine hesitancy persists despite vaccination's important role in global health. As many vaccines provide social benefits through herd immunity, vaccination decisions can raise moral concerns. Two studies explored the role of moral convictions in vaccination decisions. Study 1 ($N = 485$) revealed higher vaccination intentions when individuals thought about vaccination in moral terms. Emotions and moral piggybacking positively predicted moral convictions. In Study 2 ($N = 1{,}111$), we evaluated the effects of emotional, moral, and scientific pro-vaccination arguments on moral convictions, support for mandatory vaccination, and tolerance of dissenting views. While no group differences were observed, moral convictions were correlated with increased support for mandatory vaccination but also with a reduced tolerance of dissenting opinions. Overall, moral convictions play a small but significant role in vaccination-related decisions. While moral convictions have beneficial effects on compliance, it is crucial not to overlook the adverse consequences, which may lead to a growing societal divide.

KEYWORDS

Moral conviction; moralization; emotions; vaccine hesitancy; COVID-19

Despite the critical importance of vaccination in global health, vaccine hesitancy has been on the rise (Dubé et al., 2021). While successful vaccination programs, such as those for measles and pertussis, have led to a decrease in infection rates, they have also made it challenging to maintain high vaccination rates. Their success may have created a perception of reduced contagion risk (Fine et al., 2011). For 2023, the World Health Organization (2022) has identified increasing childhood vaccination coverage as a priority to prevent outbreaks of vaccine-preventable diseases. Many vaccines protect not only their recipients but also the entire community. Preventing widespread outbreaks is possible when a significant portion of the population becomes immune to a specific infectious agent, either through natural infection or vaccination (Fontanet & Cauchemez, 2020). This phenomenon is referred to as herd immunity, community protection, or community immunity (Dudley et al., 2020). Herd immunity is affected by factors such as the transmissibility of the infectious agent, vaccine-induced immunity, and how immunity is distributed within the population (Fine et al., 2011). It plays a crucial role in halting the spread of infectious diseases by reducing the likelihood of contact with infectious agents, thereby providing indirect protection for the unvaccinated population (Hakim et al., 2019). Additional benefits of high vaccination rates include living in a community with a low likelihood of outbreaks and a high level of public health (Giubilini, 2021).

Vaccination can be seen as a social obligation based on the principles of harm prevention and fairness (Giubilini, 2021). Attaining and sustaining herd immunity is important to the health of those who cannot receive vaccinations due to age or other factors. Moreover, vaccines have the potential to relieve the burden on overwhelmed healthcare systems and reduce the need for behavioral restrictions during pandemics (White, 2021). However, from an individual perspective, herd immunity presents

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an opportunity for free-riding, allowing individuals to avoid the personal costs and risks associated with vaccines while still benefiting from the protection conferred by society (Fine et al., 2011).

Due to the conflicting individual and societal considerations surrounding vaccination, it might be viewed as a moral issue, but this perception varies among individuals. Attitudes toward a given topic can be categorized into preferences (personal taste), conventions (norms), and moral convictions that reflect an individual's core beliefs about right and wrong (Turiel, 1983). There is variability in the extent to which individuals perceive certain issues as moral concerns, although moral convictions are more likely to be held on some issues, on average (Skitka et al., 2005). Moral convictions differ theoretically and empirically from strongly held non-moral attitudes in that they are perceived as more objectively and universally true, binding, and independent of authority. Empirical research has demonstrated that moral convictions create a sense of obligation to act in accordance with those beliefs (Skitka et al., 2021). [1]

Expanding upon this theoretical background, we hypothesized that stronger moral convictions regarding vaccinations would be associated with higher intentions to vaccinate and greater support for mandatory vaccination policies but also with decreased tolerance of differing opinions. These hypotheses were examined in the context of COVID-19 vaccines. We conducted a correlational study to investigate the association between moral convictions and willingness to receive the first dose of a COVID-19 vaccine. Subsequently, we carried out an experiment to assess the causal impact of emotional, moral, and scientific arguments on moral convictions, attitudes toward vaccine mandates, and responses to those who hold differing viewpoints.

Vaccine hesitancy

Vaccine hesitancy is defined as a "delay in acceptance or refusal of vaccination despite availability of vaccination services" (MacDonald, 2015, p. 4161). It ranges from full acceptance to complete refusal of vaccines. From a psychological standpoint, seven key factors influence vaccination decisions (the 7C model, e.g., Geiger et al., 2022): *confidence* in a given vaccine and the system that delivers it; *complacency* regarding perceived risks of the disease in question; psychological and structural *constraints*; *calculation* (extensive information searching); *collective responsibility* (the tendency to consider the protection of others in vaccination decisions); *compliance* (support for societal monitoring and sanctioning of unvaccinated individuals); and *conspiracy* (the tendency to endorse conspiratorial beliefs about vaccination).

Because vaccination decisions affect individual and collective immunity, conflicts have arisen at both the individual and societal levels. For instance, in experiments, vaccinated individuals exhibited less generosity toward their non-vaccinated counterparts and perceived them as less warm (Korn et al., 2020). Individuals who opted against vaccination differentiated less between vaccinated and non-vaccinated others. In a qualitative study, vaccine advocates expressed negative and stigmatizing views of vaccine refusers. They were believed to be "unintelligent, selfish, overly emotional, conspiratorial and scientifically illiterate" (Rozbroj et al., 2019, p. 5986). To be seen in such a negative light can, in turn, impact unvaccinated individuals: their perceptions of moral reproach, i.e., the feeling that the vaccinated were judging them as immoral, predicted a stronger refusal to get vaccinated (Rosenfeld & Tomiyama, 2022).

Increasing vaccination rates

Numerous efforts have been made to increase vaccination rates. One seemingly straightforward approach is to enforce mandatory vaccination. While announcing vaccination mandates has been shown to increase new vaccinations (Karaivanov et al., 2022), research also showed negative side effects such as reactance, as intentions to vaccinate against other diseases diminished (Betsch & Böhm, 2016).

[1]While some approaches in moral psychology specify what counts as a moral concern (e.g., the moral foundations), we deliberately avoid defining a priori what is moral. In moral conviction research, individuals define for themselves what they perceive as a moral concern. Thus, rather than assuming that others view vaccines as morally significant, we asked participants the extent to which their stance on vaccination reflected their personal moral beliefs. We do not claim that there are universally true moral standards but rather that individuals experience their moral convictions as objective facts.

Hornsey et al. (2018) criticized the reliance on a deficit model of science communication in the promotion of vaccination. A deficit model approach assumes that the unvaccinated lack access to or understanding of the available evidence. However, merely presenting evidence and dispelling myths has often proved ineffective (Horne et al., 2015). Hence, incorporating emotionally compelling content into pro-vaccination messaging has been suggested (Chou & Budenz, 2020). Content analysis of anti-vaccination platforms revealed that oppositional claims frequently appealed to emotions while supporting claims appealed to reason (Bean, 2011). A further potentially beneficial strategy could involve narrative information. In an experimental study, narratives influenced risk perception and overrode statistical information about risk (Betsch et al., 2011).

Another approach to augmenting vaccination intentions is to emphasize societal benefits. Educating individuals about herd immunity has been found to increase their willingness to be vaccinated (Betsch et al., 2017; Hakim et al., 2019; Logan et al., 2018; Pfattheicher et al., 2022). In contrast, Betsch et al. (2013) discovered that highlighting the individual benefits of herd immunity reduced vaccination intentions. Communicating the social advantages of herd immunity increased intentions when costs were low.

Moral convictions

Whether vaccination is seen as a moral issue differs among individuals. According to the domain theory of attitudes, individuals differ in the degree to which they view the same attitude object as a preference, a convention, or a moral conviction (Turiel, 1983; see also Skitka et al., 2021, for a review). Moral convictions describe attitudes that are perceived as questions of what is fundamentally right and wrong (Skitka et al., 2005). Someone might decide to get vaccinated to protect their health based on a cost – benefit analysis without considering moral factors, reflecting a preference. Another person may avoid vaccinations in keeping with the social norms of their community. Conversely, someone may opt for vaccination out of a moral concern because contributing to herd immunity aligns with their fundamental value of preventing harm.

What individuals subjectively experience as moral concerns differs theoretically and empirically from what they subjectively experience as preferences or conventions. The domain theory of attitudes predicts that individuals perceive their moral convictions as objective and universal truths, which is underscored by current research. Moral convictions have been found to be associated with a stronger perceived obligation to act upon them, increased political participation, and resistance to normative and majority influence (see Skitka et al., 2021, for a review).

Nevertheless, there is also a dark side to moral convictions, manifesting in a reduced tolerance for those who hold differing moral beliefs. Individuals with high moral convictions showed less willingness to compromise (Ryan, 2017), less tolerance for disagreement (Wright et al., 2008), and a greater desire for social and physical distance from those with opposing views (Skitka et al., 2005; Zaal et al., 2017). Polarization and conflicts with dissenters emerged as possible consequences (Ditto & Koleva, 2011; Feinberg & Willer, 2013; Greitemeyer, 2023). When moralized issues were challenged, people were found to focus more on ends than on means. To achieve morally preferred ends, they condoned lying, violence, and cheating (e.g., Mueller & Skitka, 2018; Reifen Tagar et al., 2014). Individuals were also more likely to support violent protests on moralized issues (Mooijman et al., 2018).

Influencing moral convictions: cognitive and emotional factors

The moral significance attached to issues varies across time, cultures, and individuals (Skitka et al., 2021). The process of attaching moral significance to an issue is called moralization (Feinberg et al., 2019; Rozin, 1999). It can occur at both the individual and societal levels (Rozin, 1999) and requires a two-step process: moral recognition, followed by moral amplification (Skitka et al., 2021). Moral recognition is likely to involve cognitive effort and elaboration, although emotions may also play a role (Skitka et al., 2021). It encompasses two aspects. On the one hand, an individual's existing position can be reframed in moral rather than preferential terms. For example, a formerly non-moral positive attitude toward vaccines could be reformulated as "I want to be vaccinated because it is my moral duty to protect those around me." On the

other hand, moral objections to the initial preference can be recognized. For example, a vaccine-hesitant individual might become aware of measles outbreaks due to declining herd immunity and recognize that it is morally wrong to risk harming others. Once individuals recognize that an issue can be moralized, moral amplification can occur; this refers to the moralization of conventional or weakly moralized attitudes (Skitka et al., 2021).

A few studies have attempted to influence levels of moral convictions experimentally. According to Feinberg et al. (2019), moralization is hindered by hedonic motivations (e.g., conformity, sacrifice of pleasure) and dissonance-reducing strategies (e.g., reactance, rationalizations). Both moral cognitions and moral emotions play a role in fostering moralization. One cognitive mechanism is called moral piggybacking, which describes when new experiences or information cause behavior that was previously unrelated to moral principles to be seen as either consistent with or in conflict with those principles (Feinberg et al., 2019; Rozin, 1999). Another facet of moralization involves moral emotions. Emotions have been found to both result from and predict changes in moral convictions (Clifford, 2019; Rozin & Singh, 1999; Rozin et al., 1997). Feelings of hostility (Brandt et al., 2015), disgust (Wisneski & Skitka, 2017), and guilt (Feinberg et al., 2019) have been associated with the moralization of attitudes. Additionally, perceptions of harm and benefit have been linked to attitude moralization (Rozin & Singh, 1999; Rozin et al., 1997). Research with seven-year-old subjects demonstrated that children judged unfamiliar and victimless actions as wrong after hearing testimonies involving anger and disgust and verbal assertions invoking moral principles (Rottman et al., 2017).

Political communication relies in part on emotions (Ridout & Searles, 2011), and political campaigns play a role in shaping moral convictions (Brandt et al., 2015). Clifford (2019) delved into the role of political communication in moralization, focusing on issues related to food politics, such as factory farming. Disgust- and harm-inducing messages increased moral convictions and social distancing from those who disagreed. However, those messages did not induce changes in policy attitudes. Both harm and disgust conditions predicted higher moral conviction two weeks later. It remains unclear whether emotional framing can further moralize politically salient and polarized issues such as vaccinations, although it may be possible because people have only moderate levels of moral conviction on many political issues (Clifford, 2019).

Another aspect that could influence moral convictions is the "common-is-moral" heuristic (Lindström et al., 2018). The commonness of an observed behavior has been found to influence its moral status in several experiments: behaviors were judged as more moral when common than when rare, and rare behaviors were judged as deserving more severe punishment than common ones. While this heuristic has not been studied in the context of moral convictions, the authors proposed that it could contribute to moralization through an interplay with emotions (Lindström et al., 2018).

Influencing moral behavior: moral disengagement

There is a gap between moral cognition and moral actions, as attitudes do not necessarily translate into behavior. The theory of moral disengagement (MD) aims to bridge this divide. It explains how individuals deviate from their moral compass without experiencing self-reproach (Bandura et al., 1996). Eight strategies decouple moral actions from moral standards. Originally introduced as a procedural framework, it is now also treated as a disposition: the propensity to morally disengage (Moore, 2015). A substantial body of research has linked MD to unethical behavior, workplace deviance, bullying, and misconduct within sports, among other domains (for a review, see Moore, 2015). Within the context of health, MD has been associated with lower adherence to COVID-19 guidelines (e.g., Devereux et al., 2021; Maftei & Holman, 2022). Additionally, individuals with high levels of MD have reported experiencing fewer negative life changes as a result of the COVID-19 pandemic (Aignesberger & Greitemeyer, 2023). While not yet researched in the context of vaccination, MD could serve as an additional explanatory factor for individuals' reluctance to be vaccinated despite perceiving vaccination as the morally right choice.

THE PRESENT RESEARCH: THE CONTEXT OF COVID-19

Moral psychology often overlooks the significance of context (Schein, 2020). While focusing on a specific context limits generalizability, it provides valuable insights into real-world behavior. We examined the role of moral convictions in vaccination decisions during the COVID-19 pandemic. In December 2019, the first case of the novel coronavirus infection was reported from Wuhan, China. By March 2020, COVID-19 had become a global pandemic (Amanat & Krammer, 2020), burdening healthcare systems worldwide (Giubilini, 2021). In response to this crisis, several COVID-19 vaccines were developed that were effective in preventing documented infection, symptomatic infection, severe infection, hospitalization, and death (e.g., Baden et al., 2021; Bozio et al., 2021; Dagan et al., 2021; Haas et al., 2021; Lopez Bernal et al., 2021). Reduced hospitalization can be seen as a societal benefit of vaccination, as it results in the consumption of fewer resources, thus contributing to the functioning of healthcare systems (White, 2021). Although not eliminating the transmission of SARS-CoV-2, vaccinations decreased it (e.g., Braeye et al., 2023; Eyre et al., 2022; Hoeve et al., 2023; Puhach et al., 2022; Tan et al., 2023). While this was influenced by vaccination rates, types of vaccines, and COVID-19 variants, higher vaccination uptake had protective effects on the vulnerable (Shoukat et al., 2022).

To ensure high uptake, vaccination campaigns also emphasized the potential social benefits of receiving a COVID-19 vaccine (e.g., Initiative Österreich impft, 2021). Angela Merkel, then Chancellor of Germany, stated in a press conference, "I say to all those who are still unsure whether they want to get vaccinated: Vaccination not only protects you, but also someone close to you, someone who is important to you, someone you love" (Bundesregierung, 2021, translation by the authors). Herd immunity thresholds and vaccination coverage targets were commonly mentioned in the media (Andersson et al., 2022). Consistent with this, empirical research found that prosocial motives predicted willingness to vaccinate against COVID-19 (e.g., Enea et al., 2023), as has been found for other vaccines. Hesitant adopters reported protecting one's community and oneself as the driving forces for vaccination, demonstrating that motivations for vaccination were often combined (Moore et al., 2022). COVID-19 vaccine hesitancy was predicted by low confidence in vaccine efficacy and safety, a limited sense of collective responsibility, high complacency, and high calculation (Tagini et al., 2022). In an attempt to overcome vaccine hesitancy, COVID-19 vaccination mandates were discussed. These mandatory policies elicited reactance, as they were correlated with reduced adherence to immediate protective measures related to the virus (Sprengholz et al., 2022). Divisions emerged between the vaccinated and unvaccinated, with a pronounced tendency for discrimination among vaccinated individuals (Bor et al., 2023, Henkel et al., 2023).

It should be noted that during the data collection period, it was widely believed and communicated that COVID-19 vaccines conferred societal benefits. In contrast, at present, herd immunity does not appear to be achievable due to the current variants and available vaccines. Our research is grounded in the assumption that vaccination provides protection to the community as well as the individual and should be interpreted accordingly.

Research questions

Against this theoretical background, we posited moral conviction as a starting point for interventions to increase vaccination rates. Two studies investigated the role of moral convictions in vaccination decisions, with Study 1 focusing on the positive aspects of moral convictions. This correlational study took place when COVID-19 vaccines were introduced in Western Europe in 2021, stratified by characteristics such as age and occupation.

Deriving from previous research in diverse contexts (Clifford, 2019; Feinberg et al., 2019), we anticipated that moral emotions, moral piggybacking, the perceived prevalence of COVID-19 vaccination, and knowledge about herd immunity would influence moral convictions. Moreover, we hypothesized that greater moral convictions would lead to a higher willingness to get vaccinated via a heightened emphasis on the

social benefits of herd immunity. Additionally, we explored the potential impact of MD on vaccination intentions.

In Study 2, our focus shifted to the darker side of moral convictions, such as reduced tolerance for dissenting viewpoints. This experiment was conducted during another wave of COVID-19 infections in late 2021, when getting a third shot of a COVID-19 vaccine (booster) was recommended. Simultaneously, debates concerning vaccine mandates were unfolding, with the COVID-19 vaccination poised to become the only mandatory vaccination for the entire adult population in Austria and Germany. We researched how emotional and moral arguments, compared to scientific ones, influenced moral convictions. Moreover, we gauged the effects of these arguments on the approval of mandatory vaccination and the views of dissenting others.

Both studies conformed to the Declaration of Helsinki and the good scientific practice recommendations of the European Union for Social Science and Humanities. According to the Ethics Committee of the University of Innsbruck, no ethical approval was required for this study because the guidelines mentioned were followed, no identifiable human data were gathered, and no intervention or manipulation took place in the context of this study. Participation in both studies was on a purely voluntary basis, and no compensation was given.

STUDY 1

Data collection for this preregistered study (https://aspredicted.org/95ab7.pdf) took place between June and August 2021, coinciding with the introduction of COVID-19 vaccines.

Hypotheses

To recap the previously discussed research, moral emotions and moral piggybacking have been found to influence moral convictions across diverse contexts (e.g., Clifford, 2019; Feinberg et al., 2019). Furthermore, a different line of work revealed that the common is seen as moral (Lindström et al., 2018). Moreover, for the process of moralization to take place, awareness of the potential moral dimensions of an issue is essential (moral recognition, Skitka et al., 2021). Therefore, we expected that knowledge about herd immunity would not impact solely vaccination intentions but would also influence moral convictions. Our first hypothesis was as follows:

H1: We expected moral emotions (H1a), moral piggybacking (H1b), knowledge about herd immunity (H1c), and perceived commonness of vaccination intentions (H1d) to be positively correlated with moral conviction.

A psychological determinant of vaccination intentions is the consideration of the protection of others through one's own vaccination (e.g., Geiger et al., 2022). Given the potential moral aspects of vaccination decisions, our second hypothesis was formulated:

H2: We expected knowledge about herd immunity to positively predict vaccination intentions (H2a) and moral conviction to mediate this connection (H2b). Additionally, we expected MD to act as a moderator (H2c).

Herd immunity encompasses not only societal benefits but also individual advantages, as it allows individuals to avoid vaccination if enough people around them are immune. These competing viewpoints can influence vaccination decisions (Betsch et al., 2013). Accordingly, our third hypothesis was as follows:

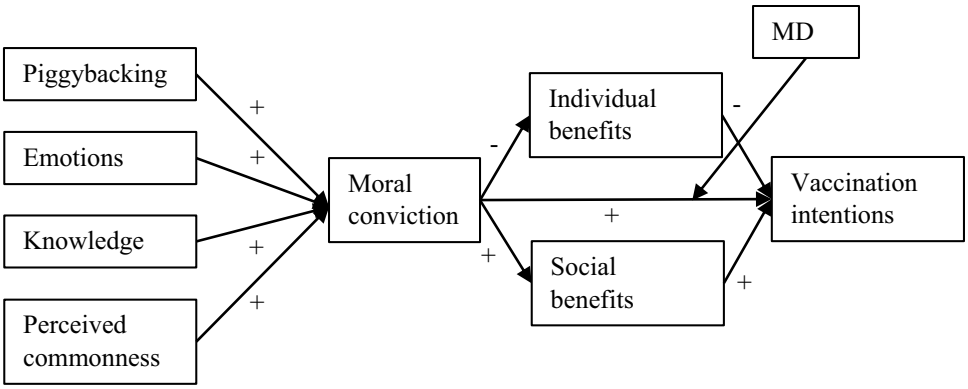

Figure 1. Proposed path model of the influence of emotions, piggybacking, and knowledge on vaccination intentions via moral conviction and attitudes toward herd immunity.

H3: We expected attitudes about herd immunity to mediate the connection between moral conviction and vaccination intentions. Specifically, we expected that moral convictions would positively predict the significance attributed to the social benefits of herd immunity, which would subsequently predict higher vaccination intentions (H3a). Conversely, we hypothesized that moral conviction would negatively predict the importance of the individual benefits of herd immunity, which would in turn negatively predict vaccination intentions (H3b). See Figure 1 for an overview of the proposed model.

Methods

Participants

Participants were recruited through social media and the university's mailing list. An a priori power analysis using G*Power determined a minimum sample size of 395 to detect small effects ($f^2 = .02$) with a power of .80. Ultimately, 489 individuals completed the survey and provided consent for data usage. After excluding two underage participants and two who completed the quiz in less than 25 seconds, data from 485 individuals were included in the analysis (68.2% female, 30.9% male, and 0.8% divers). Their ages ranged from 18 to 72 years ($M = 26.27$, $SD = 7.70$). Among participants, 43.1% reported holding a university degree, while 50.5% had a high school diploma; 74.6% were students, while 15.7% were employed; and 45.8% resided in Austria, 39.2% in Germany, and 12.0% in Italy. None of the participants had received a COVID-19 vaccination, but 39.4% reported having registered to receive a vaccine, and 7.0% stated that they belonged to a high-risk group.

Knowledge About Herd Immunity. Participants' understanding of herd immunity was assessed through a brief quiz consisting of 10 single-choice questions (e.g., "True or false: a prerequisite for herd immunity is that the pathogens are transmitted from person to person"). A definition of herd immunity was provided after the quiz, and correct solutions and scores were presented at the end of the survey.

Estimated Knowledge. Participants gauged their perceived knowledge of herd immunity from 1 = *not at all* to 101 = *very* using a single item: "How knowledgeable are you about the topic of 'herd immunity' related to vaccinations?"

Commonness of Vaccination. Participants estimated the percentage of individuals they believed would be willing to receive COVID-19 vaccinations on a slider from 0 to 100%.

Moral Emotions. Participants indicated the intensity of 10 emotions (e.g., compassion, guilt, disgust) experienced when thinking about herd immunity on a 5-point Likert scale (1 = *not at all* to 5 = *very strongly*) (Cronbach's α = .84).

Moral Piggybacking. Adapted from Feinberg et al. (2019), two items assessed moral piggybacking (e.g., "Think about the topic of herd immunity. To what extent does this make you think about your own personal morals and the values you hold?") on a 5-point Likert scale from 1 = *not at all* to 5 = *very much* (Cronbach's α = .86).

Moral Conviction. Moral conviction was measured using three items adapted from Skitka et al. (2021) (e.g., "How much are your feelings about vaccinations based on fundamental questions of right and wrong?"). Participants responded on a 5-point Likert scale from 1 = *not at all* to 5 = *very much* (Cronbach's α = .81).

Social and Individual Benefits of Herd Immunity. Participants evaluated the significance of these two aspects using a 7-point Likert scale from 1 = *not important at all* to 7 = *very important* (individual benefit: "The more people around you are vaccinated, the more likely you are to be protected without being vaccinated;" social benefits: "Those who are vaccinated protect others who are not vaccinated" and "Those who do not get vaccinated can endanger others who are not vaccinated") (Cronbach's α = .83).

Propensity to Morally Disengage (MD). Moore et al. (2012) 8-item scale was used to measure MD (e.g., "Taking something without the owner's permission is okay as long as you're just borrowing it"). Responses were provided on a 7-point Likert scale from 1 = *strong disagreement* to 7 = *strong agreement* (Cronbach's α = .72).

Vaccination Intentions. Participants were asked, "If you had the opportunity to receive a vaccination against COVID-19 right now, what would you do?" (adapted from Betsch et al., 2017). They answered on a boundless slider from 1 = *I would definitely not get vaccinated* to 101 = *I would definitely get vaccinated*.

Results

Descriptive analyses and correlations

Table 1 shows the means, standard deviations, and correlations of the main variables. Almost all participants (99.0%) gave the correct definition of herd immunity.

As expected, vaccination intentions were significantly correlated with knowledge about herd immunity, an emphasis on the social benefits of herd immunity, and moral conviction. Surprisingly, the emphasis on the individual benefits of herd immunity was also positively correlated with vaccination intentions.

Moral convictions were positively correlated with emotions (H1a) and moral piggybacking (H1b). The correlations with knowledge about herd immunity (H1c) and perceived commonness of vaccination (H1d) failed to reach significance. H1 was therefore partly confirmed.

H2: Moderated mediation model. We used the Process Macro (Model 14) for a moderated mediation analysis. We hypothesized that knowledge about herd immunity would predict willingness to get vaccinated, with moral conviction acting as a mediator. MD was expected to moderate the relationship between moral conviction and vaccination intentions. All variables were z-standardized before entering. The overall model was significant, $F(4, 480) = 11.36$, $p < .001$, accounting for 8.65% of the variance.

Vaccination intentions were positively predicted by knowledge about herd immunity ($b = 0.22$, $p < .001$) and moral conviction ($b = 0.17$, $p < .001$), supporting H2a. Given the absence of a significant path from knowledge to moral conviction ($b = 0.08$, $p = .096$), H2b was refuted. H2c also had to be

Table 1. Means, standard deviations and Pearson's correlations (Study 1)

	M	*(SD)*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Vaccination intentions	49.75	(40.44)												
2. Perceived commonness of COVID-19 vaccination	64.75	(13.33)	.27 ***	—										
3. MD	1.99	(0.77)	.01	-.03	—									
4. Estimated knowledge	64.45	(21.49)	-.06	-.08	-.11 *	—								
5. Knowledge	7.81	(1.58)	.23 ***	.18 ***	-.08	.00	—							
6. Piggybacking	3.14	(1.21)	.19 ***	.03	-.08	-.05	.02	—						
7. Emotions	1.92	(0.73)	-.05	-.05	.12 *	-.01	-.07	.32 ***	—					
8. Moral conviction	3.20	(1.09)	.19 ***	.08	-.03	.06	.08	.39 ***	.21 ***	—				
9. Social benefits	4.48	(1.84)	.74 ***	.25 ***	.03	-.05	.24 ***	.21 ***	-.03	.23***	—			
10. Individual benefits	4.41	(1.86)	.46 ***	.22 ***	.13 **	-.09 *	.16 ***	.11 *	-.01	.04	.64***	—		
11. COVID-19 infection status [a]			-.06	.02	-.08	-.02	.03	-.03	-.12 **	-.09	-.03	.02	—	
12. Age			-.08	-.06	-.03	-.01	-.09	-.02	.03	-.04	-.06	-.02	-.09	—
13. Gender[b] [0 = m, 1 = f]			.03	.07	-.19 ***	-.10 *	.00	.09 *	.14 **	.03	.06	.06	.07	-.07

Note. $N = 485$, [a]0 = never tested positive for COVID-19, 1 = at least one positive test, [b] $n = 481$, * $p < .05$, ** $p < .01$, *** $p < .001$.

rejected, as MD did not moderate the relationship between moral conviction and vaccination intentions ($F(1, 480) = 0.76$, $p = .384$, $\Delta R^2 = 0.14\%$).

In summary, although no evidence for moderated mediation was found, knowledge about herd immunity and moral conviction independently predicted vaccination intentions.

H3: Path analysis. To explore indirect effects, a path model was created using JASP v0.16.4.0 (Love et al., 2019), which is based on the lavaan package of R (see Figure 2).

As prior analyses revealed no link between the perceived commonness of vaccination and moral conviction, this variable was omitted from the model. Knowledge about herd immunity was not connected to moral conviction either (see H2). Nevertheless, as previous studies (e.g., Logan et al., 2018) have shown its importance, we retained this variable as a predictor of attitudes and vaccination intentions. All variables were standardized before they were entered. Maximum likelihood estimation with robust error calculation was used, as Mardia's coefficient for skewness was significant. The model fit was good (χ^2 (7) = 22.72, $p = .002$, BIC = 4836.009, CFI = .98, TLI = 0.95, RMSEA = .07, $p = .147$) (Hu & Bentler, 1999; Schermelleh-Engel et al., 2003). Removing the direct paths from knowledge and moral conviction to vaccination intentions did not significantly worsen the model fit ($\Delta\chi^2$ (2) = 3.90, $p = .142$). Consequently, we report the coefficients of this less restricted model (χ^2 (9) = 26.62, $p = .002$, BIC = 4827.633, CFI = .98, TLI = 0.96, RMSEA = .06, $p = .186$). This path model accounted for 54.5% of the variance in vaccination decisions. Table 2 reports the path coefficients, R^2, and indirect effects. Bootstrapping with 5,000 iterations was used to estimate the indirect effects. As the direct paths from moral conviction to individual aspects of herd immunity and from individual aspects to vaccination intentions were not significant, no indirect effects were calculated for these paths. All effects were significant, as none of the 95% confidence intervals included 0 (see Table 2). Piggybacking, emotions, and knowledge had indirect effects on the willingness to be vaccinated against COVID-19.

H3a was therefore confirmed, while H3b was not supported. Moral conviction predicted an emphasis on the social benefits of herd immunity, subsequently culminating in higher vaccination intentions. In contrast, emphasis on the individual benefits of herd immunity was neither predicted by moral conviction nor significantly predicted vaccination intentions.

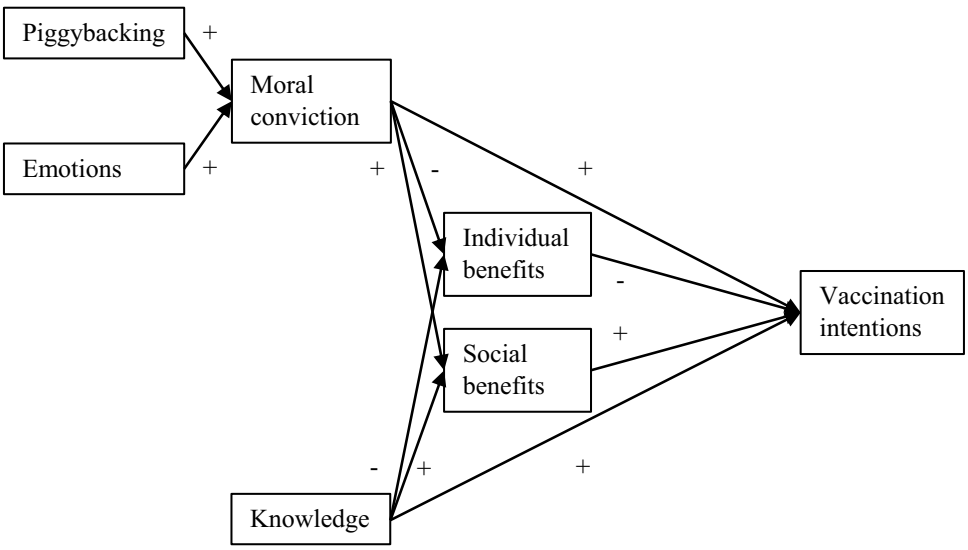

Figure 2. Proposed path model of moral conviction and knowledge about herd immunity predicting vaccination intentions.

Table 2. Regression coefficients, indirect effects, and R^2 of the path model predicting vaccination intentions

	Estimate	*SE*	*p*	95%-Confidence Interval [LL; UL]	
Outcome: moral conviction					
Piggybacking	0.35	0.04	< .001	[0.258;	0.448]
Emotions	0.10	0.04	.023	[0.014;	0.187]
Outcome: social benefits					
Moral conviction	0.21	0.04	< .001	[0.121;	0.304]
Knowledge	0.23	0.04	< .001	[0.141;	0.309]
Outcome: individual benefits					
Moral conviction	0.03	0.05	.481	[-0.067;	0.130]
Knowledge	0.16	0.05	< .001	[0.070;	0.247]
Outcome: vaccination intentions					
Social benefits	0.75	0.04	< .001	[0.686;	0.822]
Individual benefits	-0.02	0.04	.559	[-0.098;	0.052]
Residual covariance					
Social benefits~~individual benefits	0.59	0.05	< .001	[0.492;	0.685]
Indirect effects					
Piggybacking→ moral conviction→ social benefits→ Vaccination intentions	0.02	0.01	.040	[0.003;	0.033]
Emotions→ moral conviction→ social benefits→ vaccination intentions	0.06	0.01	< .001	[0.029;	0.092]
Knowledge→ social benefits→ vaccination intentions	0.17	0.03	< .001	[0.103;	0.238]
	R^2				
Moral conviction	.157				
Social benefits	.096				
Individual benefits	.026				
Vaccination intentions	.545				

Note. $N = 485$

DISCUSSION

Moral convictions played a small but significant role in vaccination intentions, particularly through their focus on the social benefits of vaccination. Our findings align with those of previous research, as moral conviction was positively influenced by piggybacking and moral emotions. Contrary to expectations, we found no support for the "common-is-moral" hypothesis, as the estimated vaccination rate was not connected to moral conviction. While knowledge about herd immunity did not influence moral conviction, it had a positive effect on vaccination decisions via an emphasis on the social benefits of herd immunity. In contrast to previous findings (Betsch et al., 2013, 2017), the focus on the individual benefits of herd immunity did not negatively influence vaccination intentions.

When interpreting these results, it is important to consider the context of the pandemic. Notably, knowledge of herd immunity was high in our sample. Almost all participants knew the correct definition, unlike in previous studies (e.g., 62.8%, Logan et al., 2018). This increased awareness could stem from the extensive media coverage of COVID-19 vaccines. That the individual benefits of herd immunity had no adverse effect on vaccination intentions may be explained by the novelty of the COVID-19 vaccines and the perceived threat of infection during a pandemic. It is possible that participants preferred to rely on personal protection through vaccination rather than rely solely on collective immunity, viewing the latter as an added advantage for others.

In summary, moral factors such as emotions and moral piggybacking influenced vaccination intentions via increased moral convictions. However, the design of Study 1 does not allow for causal inference. Therefore, we conducted an experimental study to examine the effects of different kinds of arguments about vaccination on moral convictions.

STUDY 2

The aim of this preregistered study (https://aspredicted.org/je8zu.pdf) was to replicate the first study's effects experimentally under different circumstances. Furthermore, we sought to explore potential

long-term effects using a longitudinal design. As knowledge about herd immunity was high in the previous sample and did not influence moral conviction, we did not include this factor in Study 2.

Data were collected from November 2021 until March 2022 during another "wave" of COVID-19 infections. Restrictions were in place to stop the spread, and individuals were encouraged to receive a third dose of a COVID-19 vaccine. At this time, a minority declined to get vaccinated. Consequently, politicians engaged in negotiations regarding mandatory vaccination. In Austria, the mandate was announced in December 2021, with its implementation scheduled for March 2022. Following several revisions, the mandate was eventually revoked in June 2022.

Participants were randomly assigned to one of three experimental conditions and read scientific, emotional, or moral arguments about the COVID-19 vaccine. Subsequently, we measured moral piggybacking, emotions, moral convictions, approval of mandatory vaccination, and the preferred social distance from dissenting others.

Hypotheses

As detailed in the literature review, previous research has shown that moral conviction can be influenced via moral piggybacking and moral emotions (Feinberg et al., 2019). Therefore, we hypothesized the following:

H1: We expected emotional (H1a) and moral (H1b) pro-vaccination arguments to lead to higher moral convictions regarding vaccinations compared to scientific arguments.

Moreover, research has demonstrated that individuals accept nearly any means as long as morally preferred ends are achieved (Skitka et al., 2021). This led to our second hypothesis:

H2: We expected emotional (H2a) and moral (H2b) arguments to lead to higher approval of mandatory vaccination.

Furthermore, moral convictions lead to less tolerance of opposing viewpoints (Skitka et al., 2021). Tolerance can be operationalized via the preferred social distance from individuals who hold contrasting beliefs on a moralized matter (Skitka et al., 2005). Thus, our next hypothesis was as follows:

H3: We expected emotional (H3a) and moral (H3b) arguments to lead to a higher desired social distance from dissenting others.

In Study 1, moral piggybacking and emotions forecasted moral conviction, which subsequently predicted vaccination intentions via herd immunity benefits. Based on this, we posited our fourth hypothesis:

H4: We expected to confirm the path model from Study 1 with two distinct outcomes: approval of mandatory vaccination (H4a) and desired social distance from dissenting others (H4b).

Additionally, in previous research, the effects of emotional arguments could still be observed two weeks after exposure (Clifford, 2019). Therefore, we proposed our last hypothesis:

H5 (long-term effects): We expected the effects of emotional and moral arguments to manifest even two weeks later.

Deviation from the preregistration

In the preregistration, two additional variables were named: willingness to be vaccinated and actual vaccination between T1 and T2. Only participants eligible for vaccination were asked about their vaccination intentions. This led to a too-small sample size for data analysis ($n_{T1} = 388$, $n_{T2} = 103$).

Methods

Participants

Participants were recruited through social media and the university's mailing list. The a priori power analysis in G*Power determined a sample size of 969 to detect small effects ($f = .05$) with a power of .80. A total of 1,201 individuals completed the initial survey and provided consent for the utilization of their data for scientific purposes. Ninety participants failed the manipulation check, resulting in the inclusion of 1,111 individuals in the data analysis for Study 2 T1 (30.9% male, 68.2% female). Of these participants, 12.4% were not vaccinated, 65.1% had received booster shots, and the remainder had received one or two doses. The ages ranged from 18 to 72 years ($M = 27.13$, $SD = 9.49$). Of the included participants, 46.4% lived in Austria and 44.5% in Germany; 49.6% held university degrees and 44.6% high school diplomas; 72.3% reported being students and 18.6% being employees; and 33.4% were assigned to the scientific, 34.3% to the emotional, and 32.3% to the moral group.

Despite extending the survey period by two weeks, the desired sample size for T2 could not be achieved. Ultimately, 504 participants completed both surveys and provided consent for the use of their data in scientific research. Of these participants, 29 were excluded for failing the manipulation check at T1 and 8 for providing incorrect information (e.g., stating in Survey 1 that they had received the booster shot and in Survey 2 that they had received two doses). Consequently, longitudinal data analysis was conducted on 467 participants (response rate: 42%). The mean age was 27.67 ($SD = 10.21$, range = 18–72). Of these participants, 27% were male and 71.5% female; 8.4% reported being unvaccinated and 71.7% being boosted at T1; 48% lived in Austria and 44.1% in Germany; and 33.4% belonged to the scientific, 32.8% to the emotional, and 33.8% to the moral group.

Cover Story. To mitigate potential reactance arising from attempts to influence participants' behavior, a cover story was employed. The study was presented as a pre-study to collect and assess arguments about the COVID-19 vaccine and to test questionnaires. Participants were informed that they would review a selection of both pro and con arguments, although, in reality, all participants were shown only arguments supporting vaccination. Through open-ended questions, participants could add their own arguments concerning vaccination and the vaccine mandate. These additional data were not analyzed. Participants were fully debriefed immediately after completing the second survey.

First survey (T1)

Arguments. Each group was shown 12 pro-vaccination arguments. These statements were concise, informal, and presented in the first person (e.g., in the scientific group, "I decided in favor of vaccination after rational consideration. The short- and long-term risks of COVID-19 vaccinations are much smaller than those of COVID-19 infections;" in the emotional group, "I think it's great that many people are getting vaccinated. We are all working together to end this pandemic. For that, I'm grateful to everyone who is getting vaccinated;" and in the moral group, "I think fairness is a core value of our society. This includes showing consideration for vulnerable groups. To protect them, I got vaccinated"). The emotional arguments appealed to emotions such as fear and compassion, while the moral arguments encompassed various moral values such as fairness and care. To maintain the cover story, participants rated their agreement and the persuasiveness of the arguments. These data were not used in the analysis.

Manipulation Check. To ensure the success of the manipulation, participants were presented with five statements regarding the arguments and indicated their agreement on a 5-point Likert scale (1 =

do not agree at all to 5 = *fully agree*). Sample items included "The arguments were in favor of vaccines" and "The arguments referred to scientific facts."

Sociodemographic Data, Emotions, Moral Piggybacking, Moral Convictions, Attitude. The same measurements used in Study 1 were employed to measure sociodemographic data, emotions (Cronbach's α = .83), piggybacking (Cronbach's α = .78), moral conviction (Cronbach's α = .80), and attitude toward herd immunity (social benefits Cronbach's α = .82).

Desired Social Distance from Dissenting Others. Participants rated on a 7-point Likert scale (1 = *do not agree at all* to 7 = *fully agree)* how comfortable they would feel with individuals who held opposing views on the COVID-19 vaccine as e.g., the president of their country, coworkers, or close friends. In total, there were 10 different roles (adapted from Skitka et al., 2005). Here, higher scores indicated greater acceptance of differing opinions (Cronbach's α = .94).

Attitude Toward the Vaccine Mandate. Participants expressed their stance on a potential mandate for COVID-19 vaccination among adults using a 7-point Likert scale (1 = *do not agree at all* to 7 = *fully agree*).

Vaccination Intentions. Participants who were eligible for vaccination indicated their willingness to be vaccinated immediately on a 7-point Likert scale (1 = *definitely not getting vaccinated* to 7 = *definitely getting vaccinated*).

Second survey (T2)

The follow-up questionnaire was dispatched via e-mail after a two-week interval, accompanied by a reminder after an additional week. This survey encompassed measures of the vaccination status, opinions on a potential vaccine mandate, willingness to get vaccinated, moral conviction (Cronbach's α = .81), and desired social distance from dissenting others (Cronbach's α = .92).

Results

Manipulation check

To analyze the interpretation of the arguments, an analysis of variance (ANOVA) was used. As the Levene test for variance homogeneity was $p < .20$ for scientific and emotional arguments, Welch tests were applied for those two. As predicted, there were significant differences in the perception of the scientific, emotional, and moral arguments among the groups (Welch's $F(2, 731.38) = 93.36$, $p < .001$, partial $\eta^2 = .203$, Welch's $F(2, 702.15) = 128.19$, $p < .001$, partial $\eta^2 = .267$, and $F(2, 1108) = 47.66$, $p < .001$, partial $\eta^2 = .079$, respectively). Games-Howell post-hoc tests revealed that arguments were seen as more scientific in the scientific group ($M = 3.94$, $SD = 1.07$) compared to both the emotional ($M = 2.93$, $SD = 1.20$) and the moral groups ($M = 2.99$, $SD = 1.29$, $p < .001$). Significant differences ($p < .001$) in how emotional the arguments were perceived to be were found between all groups. The emotional group ($M = 4.44$, $SD = 0.75$) scored significantly higher than the moral group ($M = 3.96$, $SD = 0.99$), which in turn showed higher scores than the scientific group ($M = 3.25$, $SD = 1.25$). For the moral aspect, a Tukey post-hoc test was conducted, revealing that the scientific group ($M = 3.99$, $SD = 0.96$) scored significantly ($p < .001$) lower than both the emotional ($M = 4.50$, $SD = 0.72$) and moral groups ($M = 4.49$, $SD = 0.75$), with no statistically significant difference between the moral and emotional groups ($p = .981$).

Correlations

Table 3 presents the means, standard deviations, and correlations among the main variables. COVID-19 vaccination status was correlated with the level of moral conviction, the desire for social distance from dissenters, and the endorsement of the vaccine mandate.

H1, H2, & H3: Group differences. To examine group differences, analyses of variance were conducted. There were significant differences in moral piggybacking, $F(2, 1108) = 3.61$, $p = .027$, partial $\eta^2 = .006$. Tukey post-hoc tests revealed that the emotional group ($M = 3.11$, $SD = 1.16$) showed significantly more moral piggybacking than the scientific group ($M = 2.88$, $SD = 1.16$, $p = .022$). The moral group ($M = 2.96$, $SD = 1.13$) did not differ significantly from the other two groups. Emotions were also significantly different between the groups, $F(2, 1108) = 32.06$, $p < .001$, partial $\eta^2 = .055$. The emotional group ($M = 2.31$, $SD = 0.74$) reported significantly more emotions than the moral group ($M = 2.09$, $SD = 0.76$), which in turn showed more emotions than the scientific group ($M = 1.88$, $SD = 0.74$), all $p < .001$. However, no significant group differences were identified in moral conviction ($F(2, 1108) = 1.66$, $p = .190$, partial $\eta^2 = .003$), approval of mandatory vaccination ($F(2, 1108) = 0.28$, $p = .754$, partial $\eta^2 = .001$), and social distance ($F(2, 1108) = 0.79$, $p = .453$, partial $\eta^2 = .001$).

In summary, despite the differences observed in emotions and moral piggybacking among the groups, these variations did not transfer to discrepancies in moral conviction, approval of mandatory vaccination, or the desire for social distance. H1, H2, and H3 therefore had to be rejected.

Table 3. Means, standard deviations, and Pearson's correlations (Study 2, Time 1)

	M(SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Vaccination intentions[a]	3.58 (2.51)	—									
2. Approval of vaccine mandate	4.76 (2.35)	.81***	—								
3. Piggybacking	2.99 (1.15)	.28***	.21***	—							
4. Emotions	2.09 (0.76)	-.19***	-.13***	.25***	—						
5. Moral conviction	3.71 (0.96)	.28***	.36***	.32***	.10***	—					
6. Social distance	2.74 (1.47)	-.38***	-.52***	-.11***	.05	-.27***	—				
7. Social benefits	5.24 (1.77)	.68***	.65***	.24***	-.07*	.42***	-.41***	—			
8. Individual benefits	3.99 (2.01)	.41***	.25***	.16***	-.01	.19***	-.13***	.47***	—		
9. COVID-19 vaccination status [0 = no, 1 = minimum 1 shot received]		.66***	.56***	.14***	-.19***	.18***	-.33***	.54***	.29***	—	
10. Age[b]		-.02	-.03	-.03	-.00	-.09**	-.03	-.03	-.02	.00	—
11. Gender [0 = male][c]		.11*	.05	.09**	.02	.10***	-.10**	.14***	.06	.07*	-.04

Note. N = 1,111, [a] $n = 388$, [b] $n = 1{,}110$, [c] $n = 1{,}101$, * $p < .05$, ** $p < .01$, *** $p < .001$

H4: Path analysis. The model proposed in Study 1 was examined with two different outcome variables (social distance and approval of the vaccine mandate). All variables were standardized prior to analysis. As this sample included vaccinated individuals, unlike the Study 1 sample, we integrated vaccination status as a predictor (i.e., having received at least one COVID-19 vaccine dose). Maximum likelihood estimation with robust error calculation was implemented. The model fit the data well (χ^2 (8) = 29.23, $p < .001$, BIC = 13810.866, CFI = .99, TLI = 0.97, RMSEA = .05, $p = .502$). Removal of the direct paths from moral conviction to approval of mandate and social distance led to a significantly worse model fit ($\Delta\chi^2$ (2) = 34.40, $p < .001$, BIC = 13831.239, CFI = .98, TLI = 0.94, RMSEA = .07, $p = .022$). Therefore, the original model is described hereafter. Table 4 shows the path coefficients, residual covariance, indirect effects, and R^2. Bootstrapping with 5,000 iterations was used to estimate the indirect paths. Overall, the indirect effects were small. In addition to its direct influence, moral conviction negatively impacted the desired distance and positively influenced the approval of mandatory vaccination via the social benefits of herd immunity. The indirect effects of emotions on the desired social distance and the vaccine mandate were not statistically significant. Although moral piggybacking displayed significant indirect effects on desired social distance and approval of the vaccine mandate, the effect sizes were minimal.

In summary, our findings demonstrate that beyond vaccination status, moral conviction predicted approval of the vaccine mandate and the desired social distance from dissenting others. The path model proposed in Study 1 was confirmed with a larger sample and different vaccination-related

outcomes. Moral convictions influenced vaccine mandate approval and intolerance of differing viewpoints. Hence, H4 was supported.

H5: Longitudinal effects. Table 5 shows the means, standard deviations, and correlations between the main variables at T2. Notably, there were strong correlations between the two measuring points.

To examine the enduring effects on moral convictions, desired social distance, and approval of mandatory vaccination, mixed ANOVAs were conducted (between – subjects variable: scientific vs. emotional vs. moral arguments; within – subjects variables: two measuring points of moral conviction, desired social distance, approval of vaccine mandate). Concerning moral conviction, there was no statistically significant interaction ($F(2, 464) = 2.26$, $p = .106$, partial $\eta^2 = .010$). Neither the main effects of time nor the experimental group were significant, $F(1, 464) = 1.60$, $p = .206$, partial $\eta^2 = .003$, and $F(2, 464) = 0.80$, $p = .449$, partial $\eta^2 = .003$, respectively. For social distance, the interaction was not statistically significant either, $F(2, 464) = 0.77$, $p = .465$, partial $\eta^2 = .003$. However, the main effect of time was significant, $F(1, 464) = 44.35$, $p < .001$, partial $\eta^2 = .087$. The score for social distance decreased over time (T1 $M = 2.50$, $SD = 1.32$, T2 $M = 2.22$, $SD = 0.89$), signifying a lower comfort level around individuals with differing views. Again, no main effect of the treatment group was observed, $F(2, 464) = 0.85$, $p = .427$, partial $\eta^2 = .004$. For approval of the vaccine mandate, the interaction yielded no significant results, $F(2, 464) = 1.79$, $p = .169$, partial $\eta^2 = .008$. However, the main effect of time was significant, $F(1, 464) = 6.25$, $p = .013$, partial $\eta^2 = .013$. Approval of the vaccine mandate decreased over time (T1 $M = 5.14$, $SD = 2.15$, T2 $M = 5.04$, $SD = 2.13$). Again, there was no main effect of the experimental group, $F(2, 464) = 0.16$, $p = .982$, partial $\eta^2 = .000$.

In summary, we found no evidence of long-term effects on the approval of mandatory vaccination, desired social distance, or moral conviction following exposure to emotional, scientific, or moral arguments. Consequently, H5 could not be supported. However, the longitudinal analysis revealed compelling insights: Over the course of two weeks, individuals became less comfortable around those with differing opinions, while at the same time, approval of mandatory vaccination sank. The level of moral conviction remained stable.

Discussion

Study 2 investigated two proposed consequences of moral convictions: a focus on ends over means (via participants' views of mandatory vaccination) and a decreased tolerance for differing viewpoints (via the desired social distance from dissenting others).

Contrary to our initial expectations, moral convictions and vaccine-related outcomes were not influenced by moral and emotional versus scientific pro-vaccination arguments. Hence, H1 to H3 had to be rejected. Nevertheless, we confirmed the path model established in Study 1 with different vaccine-related outcomes. H4 was therefore supported. As hypothesized, emotions and moral piggybacking predicted moral conviction, which in turn predicted negative attitudes toward dissenters and positive attitudes toward mandatory vaccination. As in Study 1, attitudes toward the benefits of herd immunity partially mediated these connections. In contrast to Study 1, emphasizing the individual advantages of herd immunity weakly influenced vaccine-related outcomes.

In line with the existing literature (Clifford, 2019), levels of moral conviction remained stable over the course of two weeks. In contrast, the desire for social distance from dissenting others grew over time, indicating an expanding gap between those rejecting vaccinations and those accepting them. The endorsement of mandatory vaccination declined.

While Clifford (2019) was able to experimentally increase moral convictions by exposing participants to different arguments, he focused on topics that were less prone to prior moralization. Unlike with food policies, there was already extensive discussion of vaccination at the time of data collection, so participants' preexisting opinions about vaccination were likely more established. Under these

Table 4. Path coefficients, indirect effects, and R^2 of Study 2, Time 1

	Estimate	*SE*	Standardized	*p*	95%-Confidence Interval [LL;UL]	
Outcome: moral conviction						
Vaccination status [0= no, 1 = minimum 1 shot received]	0.47	0.11	0.16	< .001	[0.27;	0.68]
Piggybacking	0.29	0.03		< .001	[0.22;	0.35]
Emotions	0.06	0.03		.039	[0.00;	0.12]
Outcome: social benefits						
Vaccination status	1.44	0.09	0.48	< .001	[1.27;	1.62]
Moral conviction	0.33	0.03		< .001	[0.28;	0.39]
Outcome: individual benefits						
Vaccination status	0.81	0.08	0.27	< .001	[0.65;	0.96]
Moral conviction	0.14	0.03		< .001	[0.08;	0.20]
Outcome: social distance						
Vaccination status	-0.50	0.10	-0.16	< .001	[-0.70;	-0.29]
Social benefits	-0.32	0.04		< .001	[-0.39;	-0.24]
Individual benefits	0.09	0.03		.003	[0.03;	0.15]
Moral conviction	-0.13	0.03		< .001	[-0.19;	-0.06]
Outcome: approval of vaccination mandate						
Vaccination status	0.94	0.08	0.31	< .001	[0.78;	1.09]
Social benefits	0.47	0.03		< .001	[0.40;	0.54]
Individual benefits	-0.08	0.02		.001	[-0.13;	-0.03]
Moral conviction	0.12	0.03		< .001	[0.07;	0.17]
Residual covariance						
Social benefits ~~ individual benefits	0.27	0.03		< .001	[0.27;	0.32]
Vaccine mandate ~~ social distance	-0.20	0.02		< .001	[-0.24;	-0.16]
Indirect effects						
Outcome: social distance						
PB[a]→MC[b]→soc. benefits→distance	-0.03	0.01		< .001	[-0.04;	-0.02]
PB→MC→indiv. benefits→distance	0.00	0.00		.015	[0.00;	0.01]
PB→MC→distance	-0.04	0.01		< .001	[-0.06;	-0.02]
Emotions→MC→soc. benefits→distance	-0.01	0.00		.045	[-0.01;	0.00]
Emotions→MC→indiv. benefits→distance	0.00	0.00		.108	[0.00;	0.00]
Emotions→MC→distance	-0.01	0.00		.061	[-0.02;	0.00]
MC→soc. benefits→distance	-0.11	0.01		< .001	[-0.14;	-0.08]
MC→ indiv. benefits→distance	0.01	0.01		.012	[0.00;	0.03]
Outcome: approval of vaccine mandate						
PB→MC→soc. benefits→mandate	0.04	0.01		< .001	[0.03;	0.06]
PB→MC→indiv. benefits→mandate	-0.00	0.00		.009	[-0.01;	0.00]
PB→MC→mandate	0.04	0.01		< .001	[0.02;	0.05]
Emotions→MC→soc. benefits→mandate	0.01	0.01		.041	[0.00;	0.02]
Emotions→MC→indiv. benefits→mandate	-0.00	0.00		.098	[0.00;	0.00]
Emotions→MC→mandate	0.01	0.00		.052	[0.00;	0.02]

(*Continued*)

Table 4. (Continued).

MC→soc. benefits→mandate	0.16	0.02	< .001	[0.12;	0.19]
MC→indiv. benefits→mandate	-0.01	0.00	.007	[-0.02;	0.00]
	R^2				
Moral conviction	0.127				
Social benefits	0.394				
Individual benefits	0.103				
Social distance	0.207				
Approval of vaccine mandate	0.503				

Note. N = 1,111, [a]PB = moral piggybacking, [b]MC = moral conviction

Table 5. Means, standard deviations, and Pearson's correlations (Study 2, Time 2).

	M(SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Vaccination intentions T1 [a]	3.74 (2.50)	—													
2. Vaccination intentions T2 [b]	2.98 (2.29)	.86***	—												
3. Approval of vaccine mandate T1	5.14 (2.15)	.83***	.81 ***	—											
4. Approval of vaccine mandate T2	5.04 (2.13)	.82***	.80 ***	.92 ***	—										
5. Piggybacking	3.04 (1.12)	.18*	.18	.18 ***	.16 ***	—									
6. Emotions	2.11 (0.76)	-.27**	-.28 **	-.10 *	-.08	.23 ***	—								
7. Moral conviction T1	3.82 (0.89)	.27 **	.21 *	.34 ***	.37 ***	.25 ***	.13 **	—							
8. Moral conviction T2	3.78 (0.89)	.19 *	.06	.30 ***	.33 ***	.13 **	.15 **	.58 ***	—						
9. Social distance T1	2.50 (1.32)	-.48 ***	-.47 ***	-.60 ***	-.61 ***	-.08	-.03	-.30 ***	-.24 ***	—					
10. Social distance T2	2.22 (0.89)	-.45 ***	-.43 ***	-.54 ***	-.55 ***	-.14 **	-.03	-.28 ***	-.25 ***	.73 ***	—				
11. Social benefits	5.56 (1.54)	.68 ***	.69 ***	.64 ***	.65 ***	.16 ***	-.07	.34 ***	.30 ***	-.50 ***	-.44 ***	—			
12. Individual benefits	4.05 (1.98)	.42 ***	.48 ***	.23 ***	.22 ***	.13 **	-.01	.13 **	.05	-.20 ***	-.15 **	.34 ***	—		
13. COVID-19 vaccination status [0 = no, 1 = minimum 1 shot received]		.69 ***	.62 ***	.57 ***	.56 ***	.11 *	-.19 ***	.15 **	.10 *	-.38 ***	-.32 ***	.52 ***	.24 ***	—	
14. Age		-.07	-.03	-.07	-.04	-.01	.05	-.10 *	-.07	-.01	.06	-.09	-.06	.02	—
15. Gender [0 = m, 1 = f][c]		.20 *	.23 *	.05	.04	.05	.03	.12 **	.14 **	-.13 **	-.08	.16 ***	.03	.11*	-.07

Note. $N = 467$, [a] $n = 132$, [b] $n = 103$, [c] $n = 460$, * $p < .05$, ** $p < .01$, *** $p < .001$

conditions, prolonged exposure to arguments from multiple sources may be necessary to successfully change moral convictions.

Overall, moral conviction played a modest yet noteworthy role in shaping vaccination attitudes, for example, in predicting the stance on mandatory vaccination. This finding is consistent with the assertion in the moral conviction literature that outcomes outweigh methods in the context of moralized issues (Skitka et al., 2021). Interestingly, those refusing vaccination were less morally convicted of their stance and more tolerant of those who were vaccinated. As non-moralized attitudes are easier to change, this is a promising finding for public health.

GENERAL DISCUSSION

Morality undeniably plays a role in vaccination. Moral convictions were found to be associated with higher vaccination intentions (Study 1), a higher approval of mandatory vaccination, and a higher desire for social distance from those with different opinions (Study 2). Emotions and moral piggybacking emerged as predictors of moral convictions, while the perceived prevalence of vaccination was not linked to moral convictions. Positive attitudes toward the societal benefits of herd immunity acted as a mediator between moral convictions and vaccination intentions.

Although knowledge about herd immunity did not directly impact moral convictions, it was positively related to vaccination intentions via the perceived societal benefits of herd immunity (Study 1). Notably, emphasis on the individual benefits of herd immunity has been found to encourage freeriding in other studies (Betsch et al., 2013). In our studies, however, the influence of societal benefits outweighed that of individual benefits. Consequently, it seems advisable for public health campaigns to emphasize the collective benefits of vaccination in addition to the individual benefits. Nevertheless, while the protection of others accounted partly for vaccination intentions, it is essential to recognize the contribution of other factors within the 7C framework (confidence, complacency, constraints, calculation, collective responsibility, compliance, and conspiracy, e.g., Geiger et al., 2022). Identifying which of these factors are influential in specific contexts is necessary for successful interventions.

Exposure to emotional and moral versus scientific arguments in favor of vaccination did not affect vaccination intentions, endorsement of vaccine mandates, or the desired social distance from dissenters. This lack of success could be attributed, in part, to reactance (Brehm & Brehm, 1981), particularly among unvaccinated participants. Public and private pressure to conform to vaccination recommendations may have caused hesitant individuals to feel that their decisions were not respected. Coercion can be experienced as a restriction of freedom, leading in turn to a reaction opposite to the desired one. Additionally, the absence of effects could be due to pre-treatment bias. While Clifford (2019) managed to raise moral convictions through brief emotional statements, he focused on less prevalent topics, which may have been more amenable to influence. In contrast, COVID-19 vaccinations were widely discussed at the time of data collection, rendering short interventions less effective due to already entrenched opinions. Furthermore, the different levels of personal significance and proximity between vaccines and food policies may also have contributed to the lack of effect.

Moral conviction was found to be linked to higher vaccination intentions and support for mandatory vaccination. While complete consensus on health policies or governmental recommendations is probably unattainable, moral convictions can help individuals adhere to necessary yet undesirable measures that prioritize the common good over personal benefit. However, a drawback of this is that moral convictions are often associated with reduced tolerance for divergent viewpoints, as illustrated by the desire to maintain distance from those with dissenting opinions. This can widen rifts in society, fostering discrimination and ostracism. Applying moral frameworks to health-related measures thus becomes a double-edged sword (see, e.g., for obesity, Ringel & Ditto, 2019). Täuber (2018) argued that the moralization of health behaviors can undermine social cohesion by stigmatizing those who deviate from moral norms. Nonetheless, it is essential to distinguish between individual health factors and vaccination, as the latter can impact the community through herd immunity. In this

context, leveraging moral convictions could serve as a valid strategy to increase compliance with public health measures. Naturally, this approach should be limited to vaccinations that provide societal benefits. Additionally, it is imperative to explore strategies that mitigate the adverse impacts of moral convictions while preserving their positive aspects.

Limitations and future directions

While observing specific contexts helps bridge the gap between morality as experienced and as studied (Schein, 2020), this approach has inherent drawbacks, such as the limited generalizability of the results. Our research focused on COVID-19 vaccinations. To extend the applicability of our findings to other vaccines, several factors must be considered.

At the time of the study design and data collection, it was estimated that achieving population-wide immunity against COVID-19 would require an immunization coverage of 60–70% (e.g., Clemente-Suárez et al., 2020). Therefore, our results should be interpreted in the context of vaccinations that confer communal benefits. Estimates of herd immunity thresholds for COVID-19 have changed over time. While some societal benefits are evident (e.g. Braeye et al., 2023; Eyre et al., 2022; Hoeve et al., 2023; Puhach et al., 2022; Tan et al., 2023), it does not appear feasible to achieve herd immunity with currently available vaccines, although the development of intra-nasal vaccines seems promising (e.g., Diallo et al., 2023). These changing conditions do not diminish the significance of our findings, as herd immunity was a widely communicated public health goal at the time of data collection. On the contrary, the observed effects may be even more pronounced for well-established vaccinations with documented herd immunity effects, such as measles (Plans-Rubió, 2021) or human papillomavirus (Drolet et al., 2019). Further research could consider experimentally varying the degree of communal protection and assessing its impact on moral convictions.

Furthermore, it is important to note that the studied population had access to COVID-19 vaccinations free of charge. In contrast, other vaccines can be costly, depending on factors such as age group, health insurance, and geographic location. Financial considerations and moral convictions interact, at least with respect to resource use. Bastian et al. (2015) found that the influence of moral convictions was weaker when economic benefits were high. The interplay between economic costs and moral convictions in the context of vaccination warrants further research. Moreover, the unprecedented speed at which COVID-19 vaccines were developed may have potentially led to concerns about trustworthiness, an aspect that deserves attention in further research. Additionally, the perceived threat posed by a global pandemic may differ considerably from the perceived threat posed by other vaccine-preventable diseases. This perception likely heightened vaccination intentions independently of morality-related factors. Connected with this is the prominence of COVID-19 vaccines in the media and everyday conversations during our data collection period, in contrast to the infrequent discussion of routine vaccinations. The influence of emotions and moral factors may be even more pronounced in the context of other vaccines.

Another limitation of our study pertains to the sample, which consisted predominantly of individuals from Western Europe. Cultural differences in vaccination decisions have been found (Adams & Salter, 2007; Böhm et al., 2016; Lechuga et al., 2011). Individuals with individualistic or hierarchical worldviews have been found to exhibit higher levels of anti-vaccination attitudes (Hornsey et al., 2018), whereas greater cultural collectivism correlated with higher COVID-19 vaccination intentions and acceptance (Leonhardt & Pezzuti, 2022). Additionally, vaccine hesitancy has been found to vary across ethnic minority groups (Razai et al., 2021). These findings underscore the importance of culturally sensitive approaches to public health initiatives, as universal solutions are unlikely.

Another interesting question that remains is how the opposite of moralization, de-moralization, works. While moral conviction can lead to negative outcomes, such as the reduced tolerance for dissenting viewpoints demonstrated in Study 2, the circumstances under which the benefits outweigh the drawbacks, and vice versa, warrant investigation. Insights into attitude de-moralization could be gained from studies on attitude changes. For instance, Skitka et al. (2021) proposed the following

strategies for de-moralization: reframing harm as neutral or beneficial, reducing emotional content, and moralizing an alternative position. These ideas remain to be tested empirically.

CONCLUSION

In local and global health, it is imperative to account for psychological factors. The extent to which individuals view vaccination through a moral lens influences their behavior and attitudes toward those who disagree. While moral convictions can enhance compliance with essential public health measures, the risk of discrimination also increases.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, VA, upon reasonable request.

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