RUNNING HEAD: Promoting COVID-19 Vaccination Intentions

Information about herd immunity and empathy promote COVID-19 vaccination intentions

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Abstract

Objective: An effective vaccine against COVID-19 is a desired solution to curb the spread of the disease. However, vaccine hesitancy might hinder high uptake rates and thus undermine efforts to eliminate COVID-19 once an effective vaccine is available. The present contribution addresses this issue by examining two promising ways of increasing the intention to get vaccinated against COVID-19.

Methods: We conducted two pre-registered online studies (N = 2,315 participants from the UK) in which we either measured (Study 1) or manipulated (Study 2) knowledge about and beliefs in herd immunity, as well as empathy for those most vulnerable to the virus. As a dependent variable, we assessed individuals' self-reported vaccination intention if a vaccine against COVID-19 became available.

Results: We show that the motivation to get vaccinated against COVID-19 is related to and causally promoted by both mere information about herd immunity and by empathy. Thus, interventions that combine cognitive and affective information related to others' potential suffering appear most effective in increasing the intention to get vaccinated against COVID-19.

Conclusions: The present research provides a better understanding of the intention to get vaccinated against COVID-19 and highlights two evidence-based possibilities for policymakers in promoting vaccine uptake.

Keywords: COVID-19; Herd Immunity; Empathy; Prosociality; Vaccination

Introduction

The World Health Organization describes the release of a vaccine as a "vital tool" to combatting the COVID-19 pandemic (WHO, 2020a). As this pandemic continues to severely harm societies across the globe, researchers and governments are accordingly expending tremendous effort to develop a safe and efficient vaccine against COVID-19; in fact, within only a few months of the outbreak of the pandemic, several vaccine candidates had already entered phase III of clinical testing, in which efficacy, effectiveness, and safety of the vaccine candidates are tested in large, randomized controlled trials (WHO, 2020b).

At the same time, however, WHO warns that the release of an effective vaccine will not on its own provide an end to the current pandemic (WHO, 2020a). Thus, there remains a gulf between developing a vaccine and ensuring sufficient popular uptake of the vaccine (Dubé et al., 2013). To halt the spread of an infectious disease, a sufficient percentage of a population is required to become immune to it (e.g., through vaccination) such that chains of infection are interrupted—a phenomenon often referred to as 'herd immunity' (Fine et al., 2011). Estimations of population-wide vaccination rates to achieve elimination of COVID-19 due to herd immunity range from 43% to 82% (Britton et al., 2020; Sanche et al., 2020).

In Western democracies, any mandatory vaccination policy is normatively problematic and will most likely be met with significant controversy (Betsch & Böhm, 2016; Sprengholz & Betsch, 2020). From the perspective of ensuring sufficient vaccine uptake, it is therefore concerning that a significant proportion of people are hesitant to get vaccinated against COVID-19. Mullen O'Keefe (2020) report that in late July 2020, only 65% of US citizens are committed to getting vaccinated against COVID-19—even if a vaccine was FDA-approved and available to them at no cost. Similar numbers in vaccination hesitancy can be observed in many European countries (Betsch et al., 2020; Murphy et al., 2020; Neumann-Böhme et al., 2020).

In the case of COVID-19, this hesitancy may reflect challenges that are both informational and motivational. Informationally, the COVID-19 pandemic has led to an "infodemic" that is, the deliberate and massive circulation of "wrong information to undermine the public health response" (WHO, 2020c). Given the historical abundance of conspiracy theories about vaccines, it is unsurprising that COVID-19 vaccination has also been a key target of misinformation (e.g., Imhoff & Lamberty, 2020; Pummerer et al., 2020), something that may have led to increased vaccine hesitancy during the pandemic (Sprengholz et al., 2020).

Added to this informational challenge is an equally potent *motivational* challenge—that is, motivating vaccination even among those not directly at risk of severe illness from COVID-19. The mortality profile of COVID-19 is strongly correlated with age (Promislow, 2020); hence, herd immunity can only be reached if large segments of society, even those not a significant risk, are willing to get vaccinated. This problem is attenuated by the fact that the supply of any efficient vaccine will be exceptionally limited in the initial months after development and that vaccines in general are often less effective among the elderly due to their lower immune response, making it less cost-effective to use the limited vaccines on those most at risk (Gustafson et al., 2020). Accordingly, it is likely that the initial groups to be offered a vaccine will be groups such as caretakers or healthcare professionals who are mainly being vaccinated not for their own sake but to protect vulnerable groups.

The present contribution seeks to address both the informational and motivational challenges related to ensuring voluntary uptake of a COVID-19 vaccine among non-vulnerable groups. To meet the informational challenge, we specifically test whether information that establishes accurate public perceptions of the concept of herd-immunity will increase people's vaccination intention. To meet the motivational challenge, we further tested whether inductions of *empathy* for those most vulnerable to COVID-19 can motivate people to get vaccinated in order to protect vulnerable others, even if people are themselves not at a significant risk. Finally, we also tested the interaction between mere information and empathy, that is, whether *combining* herd immunity information with the "emotional fire" of affective empathy (p.1053, Batson et al., 1995) has a synergetic effect on the intention to get vaccinated against COVID-19.

Our research contributes to both theory and practice. From a theoretical perspective and in line with recent research (e.g., Böhm et al., 2019, 2016; Korn et al., 2020; Shim et al., 2012), the present research conceptualizes getting vaccinated as a prosocial act: Through vaccination, one can contribute to protecting those at high risk from a COVID-19 infection and/or who cannot get vaccinated, like those suffering from certain chronic diseases (Rubin et al., 2014). We show that prosocial vaccination may be promoted by correct perceptions about the prosocial aspects of vaccination decisions as well as by emotions related to others' potential suffering. In other words, prosocial vaccination appears to be related to both cognitive and affective aspects of human prosociality. From a practical perspective, the present research provides direct evidence for policymakers on how to tailor their communication to convince a sufficient number of people to agree to vaccination against COVID-19, and ultimately, to save lives.

Vaccination as a prosocial act: Protecting others through herd immunity

Vaccination provides a direct (personal) benefit by eliminating or at least reducing the likelihood of infection with the particular disease. In addition, most vaccines also provide indirect benefits to other, unvaccinated people due to herd immunity. Considering the costs associated with getting vaccinated (e.g., time of getting vaccinated, risk of vaccine-adverse events), vaccination constitutes a prosocial act, particularly when there is already high vaccine uptake in the population or when people are themselves not at risk of severe disease symptoms (e.g., Betsch et al., 2013; Böhm et al., 2016).[1] The latter is of particular importance in the context of the COVID-19 pandemic.

Research conducted prior to the COVID-19 pandemic has shown that people are sensitive to information about herd immunity, suggesting that knowing about and believing in herd immunity increases prosocial motivations to get vaccinated. For example, in a cross-cultural online experiment, Betsch and colleagues (2017; see also Betsch & Böhm, 2018; Sprengholz & Betsch, 2020) did vs. did not provide information about herd immunity (either with a text-based explanation or an interactive simulation) and found that participants increased their vaccination intention, particularly in Western countries and when there were low individual incentives to get vaccinated (i.e., an already high vaccination rate). Furthermore, it has been shown that vaccination and, thus, contributing to herd immunity, is represented as a 'social contract,' indicated by vaccinators' tendency to 'reward' vaccinated others but to 'punish' unvaccinated others (Korn et al., 2020). Building on these findings, in two studies reported below, we empirically tested the idea that increased knowledge about and belief in herd immunity is related to (Study 1) and can be *used* to promote the intention to get vaccinated against COVID-19 (Study 2).

Empathy, prosociality, and health behaviors

Understanding the prosocial nature of vaccination is one thing. Being motivated to engage in this prosocial act is another. In understanding the latter decision, theoretical and empirical work is increasingly oriented towards the concept of empathy. Empathy can be defined

[1] Note that with increasing vaccine uptake in the population, the likelihood of contracting the disease oneself decreases because of the herd immunity benefits provided by others. As such, free-riding incentives of benefitting from rather than contributing to herd immunity increase (for a formal description, see e.g., Bauch & Earn, 2004; Böhm et al., 2016).

as an umbrella term capturing the range of a person's responses to another individual's experience (Hodges & Myers, 2007). Past research has convincingly demonstrated the beneficial consequences of both affective as well as cognitive empathy for the welfare of others. Specifically, cognitive empathy (i.e., taking the perspective of others) has been linked to reductions of inter-group conflicts and prejudice, while affective empathy (i.e., a concern for and an understanding of vulnerable others) has been shown to promote altruism and caring (Batson et al., 1981; Sassenrath et al., 2016; Todd & Burgmer, 2013).

In the modern health context, affective empathy in particular has been shown to improve health outcomes. For instance, physicians' affective empathy levels have been positively associated with reduced metabolic complications and better self-care in diabetic patients (Hojat et al., 2011; Del Canale et al., 2012). Affective empathy has further been shown to promote healthcare professionals' adherence to handwashing compliance in order to protect others in hospitals (Sassenrath et al., 2016; Grant & Hofmann, 2011). In the context of COVID-19, it has further been shown that affective empathy promotes the motivation to engage in physical distancing and in wearing of face masks (Pfattheicher et al., 2020).

Overall, past research suggests that empathy motivates a variety of behavioral outcomes aimed at helping and protecting vulnerable others. Based on the notion that getting vaccinated is a prosocial act that helps to protect vulnerable others, we argue that empathy for those most vulnerable to the virus can promote the motivation to get vaccinated against COVID-19. Indirect evidence for this hypothesis comes from Böhm et al. (2019), who have shown that the motivation to get vaccinated increases when other people are unable themselves to get vaccinated (e.g., due to a chronic disease); it might be that empathy for those vulnerable others has driven individuals' increased vaccination motivation. In sum, in two studies reported below, we empirically tested the idea that stronger empathic concern for those most vulnerable to the virus is related to (Study 1) and can be *used* to promote the intention to get vaccinated against COVID-19 (Study 2).

Ethics statement

The two studies reported below were conducted in line with the Declaration of Helsinki and the guidelines of the American Psychological Association (APA). Participants gave informed consent before starting the study. There was no deception of participants. Both studies were preregistered. Data, materials, and the preregistrations are available on the Open Science

Framework (OSF; https://osf.io/4395f/). All results remain robust in terms of significance levels and effect sizes when controlling for participants' gender and age. We applied attention checks to secure high data quality ("This is an attention check. Please answer: Strongly agree."); less than 5.7% of participants failed the attention checks in each study. All results hold when all subjects are included.

Study 1

Method

Study 1 consists of a sample from the UK which was collected on September 7, 2020. At that time, several vaccine candidates were in clinical trial phase III, but none of the involved companies or public institutions had applied for official approval from national health authorities (this status also holds for Study 2).

Participants. Participants were recruited via the crowdsourcing platform Prolific Academic to complete a short survey on "coronavirus (COVID-19)" in exchange for 1.13£ (~1.46 US Dollar). Sample size was based on an *a priori* power analysis to detect effects of $r >$ .18 with high statistical power (Power = .90; alpha-level of .05, two-tailed). Based on this analysis, we aimed to collect at least 300 participants (final samples: 310 participants, 68.4% female, $M_{age} = 34.64$, $SD = 13.33$).

Herd immunity. We measured knowledge about and belief in herd immunity by two items. First, participants read, "How likely is this statement to be true? 'When you get vaccinated against the coronavirus, you're protecting not only yourself but also your community: When a sufficient percentage of a population has become immune to an infection (e.g., through vaccination), this reduces the likelihood of infection for individuals who lack immunity.' Labels ranged from 1 = "very unlikely to be true" to 5 = "very likely to be true." Regarding the second item, participants read on the next page, "On the last page, we referred to the concept of herd immunity: 'When a sufficient percentage […] who lack immunity.' How much do you agree with the following statement: Herd immunity through vaccination will be an important measure to slow down the spread of the coronavirus." Labels ranged from 1 = "strongly disagree" to 5 = "strongly agree." The two items were highly correlated ($r = .70$, $p < .001$) and averaged as preregistered ($M = 4.25$, $SD = 0.94$).

Empathy. We measured affective empathy for those most vulnerable to the virus with the three items from Pfattheicher et al. (2020). The items (Cronbach's α = .89) read, "I am very concerned about … / I feel compassion for … / I am quite moved by what can happen to … those most vulnerable to coronavirus (COVID-19)." Labels ranged from 1 = "strongly disagree" to 5 = "strongly agree." We observed relatively high levels of empathy (M = 4.17, SD = 0.73).

Vaccination intention. In line with previous research (Betsch et al., 2013, 2017; Böhm & Betsch, 2018), we measured the intention to get vaccinated against COVID-19 with one simple and straightforward item: "If you had the opportunity to get vaccinated against the coronavirus (COVID-19) immediately, what would you do?" Labels ranged from 1 = "I would definitely *not* get vaccinated" to 5 = "I would definitely get vaccinated." We observed medium to high levels of vaccination intention with considerable variability (M = 3.96, SD = 1.37).

Personality. To apply a conservative test to the correlations among herd immunity, empathy, and vaccination intention, we aimed at showing the robustness of effects beyond basic personality traits (as preregistered). In fact, personality traits typically already capture a significant amount of variance in individual differences in motivations and behavior (e.g., Soto, 2019; Thielmann et al., 2020), so in our analyses, we controlled for basic personality traits by including the prominent HEXACO personality dimensions as covariates. The HEXACO personality model (Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness) was assessed at the beginning of the study with the 60-item version of the HEXACO Personality Inventory-Revised (HEXACO-60; Ashton & Lee, 2009; 10 items per dimension). All dimensions had good reliability (all α > .77). None of the HEXACO dimensions played a major role in predicting vaccination intention; the largest correlation was found for Emotionality, r = .14, p = .013 (see the OSF for detailed results).

Results and discussion

In line with the idea that knowing about and believing in herd immunity relates positively to the intention to get vaccinated, we document a positive correlation between herd immunity knowledge/belief and the intention to get vaccinated against COVID-19, r = .58, p < .001. The correlation holds when the HEXACO personality dimensions were controlled for, $r_{partial}$ = .55, p < .001 (see OSF for detailed results). In a similar vein, empathy for those most vulnerable to the virus relates positively to vaccination intention, r = .26, p < .001. Again, the correlation holds when the HEXACO personality dimensions were controlled for, $r_{partial}$ = .19, p < .001 (see OSF

for detailed results). When herd immunity and empathy were simultaneously entered in a linear regression model to predict vaccination intention (non-preregistered), herd immunity was still a significant predictor, $B = .81$, $SE = 0.07$, $p < .001$, whereas the effect of empathy decreased and was no longer significant at conventional significance levels, $B = .16$, $SE = 0.09$, $p = .073$ (including or excluding the HEXACO did not play a role in this analysis).

In sum and supporting our preregistered hypotheses, the first study shows that the intention to get vaccinated against COVID-19 is predicted by, and relates to, knowledge about and belief in herd immunity, as well as to empathy for those most vulnerable to the virus. In a second study, we went one step further and sought to test whether we can *use* information about herd immunity and empathy to promote (in a causal sense) the motivation to get vaccinated against COVID-19.

Study 2

Method

Participants. Participants were recruited via the crowdsourcing platform Prolific Academic to complete a short survey on "coronavirus (COVID-19)" in exchange for 0.50£ (~0.65 US Dollar). We aimed to collect 2,000 participants for Study 2 (four between-subjects conditions). With this sample size, we can detect main effects and interaction effects of Cohen's $f > 0.062$ with sufficient statistical power (Power = .80; alpha-level of .05, two-tailed). In addition, with $n = 500$ in each condition, we obtain statistical power of > .97 to show effects larger than Cohen's $d > .25$ between two conditions (simple effects). Study 2 (final $N = 2005$; 63.4% female, $M_{age} = 34.34$, $SD = 13.42$) was run in the UK on September 5, 2020. Participants were recruited as in Study 1; we made certain that participants were unable to participate in both studies reported in the present contribution.

Experimental conditions. Participants were randomly assigned to one of four conditions: the 'herd immunity condition' ($n = 498$), the 'empathy condition' ($n = 495$), the 'empathy + herd immunity condition' ($n = 519$), and the 'control condition' ($n = 493$). Full instruction materials of the conditions can be found on the OSF (https://osf.io/4395f/).

Participants in the herd immunity condition were informed about the concept of herd immunity and its effects, in line with previous research (Betsch et al. 2017; Betsch & Böhm, 2018). Participants read, "Did you know that when you get vaccinated, you're protecting yourself and your community? This concept is called herd immunity. Herd immunity denotes the

effect that occurs when acquired immunity against a pathogen within a population (the 'herd'), generated through infection or vaccination, has reached such a level that non-immune individuals in the population are also protected because the pathogen can no longer be transmitted. Thus, if you get vaccinated, then you can protect others who are not vaccinated." On the page where the text about herd immunity was presented, the "next" button to proceed with the study was displayed only after 15 seconds elapsed.

Empathy was induced following the basic procedure of Pfattheicher et al. (2020). That is, participants in the empathy condition read an empathy-promoting short story (taken from *The Guardian*) about two siblings who shared a close bond and worked together in a nursing facility that specialized in the care of elderly people with cognitive issues. The story focused on one of the siblings, Josh, who was described as a "helpful, empathetic nurse who makes things easier for everybody." Participants read further, "Both [siblings] got tested for COVID-19 on the same day in June. Both tests came back positive. Yet only one of them survived." Participants learned that it was Josh who died. On the page where the text was presented, the "next" button to proceed with the study was displayed only after 60 seconds elapsed.

Participants in the empathy + herd immunity condition first read the empathy eliciting text about the two siblings then read the information about herd immunity. In the control condition, no text and information were given, resembling a situation of no intervention. In order to avoid unequal dropout between conditions, participants in all conditions read all texts: participants in the empathy condition read the text about herd immunity at the end of the study (before the concluding demographics were assessed); participants in the herd immunity condition instead read the empathy eliciting text at the end of the study, while participants in the control condition read both texts at the end of the study.

Vaccination intention. The motivation to get vaccinated against COVID-19 was measured with the same items as in Study 1. Labels ranged from 1 = "I would definitely *not* get vaccinated" to 7 = "I would definitely get vaccinated."

State empathy. After the item measuring vaccination intention, participants responded to three items assessing state empathy, as in previous research (Batson et al., 1997; Pfattheicher et al., 2019, 2020). The items ($\alpha = .87$) read, "Right now, I feel compassion for those most vulnerable to coronavirus (COVID-19)"; "Right now, I am touched by those most vulnerable to coronavirus (COVID-19)"; and "Right now, I am quite moved by what can happen to those most

vulnerable to coronavirus (COVID-19).” Labels ranged from 1 = “strongly disagree” to 7 = “strongly agree.”

Additional measures. To test the possibility that information about herd immunity and an additional empathy-induction makes one sensitive for one’s own vulnerability, which in turn promotes one’s (egoistic) motivation to get vaccinated, we assessed individuals’ subjective vulnerability. We tested whether subjectively considering themselves as vulnerable (vs. less so) would lead to increased vaccination intention (to protect themselves) after reading about herd immunity and the empathy-induction. In line with Pfattheicher et al. (2020), participants’ subjective own vulnerability was measured with one item (“What do you think the danger is that you will be infected with the novel coronavirus?”). We also measured perceived vulnerability of others (“What do you think the danger is that other people will be infected with the novel coronavirus?”). Labels ranged from 1 = “very harmless” to 7 = “very dangerous.” We also assessed individuals’ objective vulnerability—whether a participant is in a high-risk group (n = 551, 36.1%) or not (n = 973, 63.8%), according to the criteria of the Robert Koch Institute[2] (e.g., whether one is above 50 years old, a smoker, chronically ill).

Results and discussion

We first tested whether the conditions differed in state empathy. Analysis of variance yielded a significant main effect of the experimental empathy-induction, $F(1, 2001) = 24.73$, $p < .001$, $\eta^2 = .01$, in that participants report higher state empathy levels when the empathy-eliciting text was provided ($M = 5.79$, $SD = 1.11$) compared to when this was not the case ($M = 5.54$, $SD = 1.17$; Cohen’s $d = 0.22$). There was no significant main effect of herd immunity, $F(1, 2001) = 0.13$, $p = .72$, $\eta^2 = .00$, and no significant interaction between empathy and herd immunity, $F(1, 2001) = 0.03$, $p = .85$, $\eta^2 = .00$. These findings speak to a successful induction of empathy, in that state empathy was increased by the empathy-eliciting text but not by providing information about herd immunity.

Next, we tested our central (preregistered) hypotheses regarding whether providing mere information about herd immunity, and whether inducting empathy, increases the intention to get vaccinated against COVID-19. Means of the conditions are presented in Figure 1. Analysis of variance yielded a significant main effect of the herd immunity information, $F(1, 2001) = 8.94$ p

[2] The Robert Koch Institute is the German federal government agency for disease control and prevention.

= .003, η^2 = .004, in that participants report higher vaccination intention when the informative text about herd immunity was provided (*M* = 5.65, *SD* = 1.77) compared to when this was not the case (*M* = 5.41, *SD* = 1.88; Cohen's *d* = 0.13). We can also document a significant main effect of the experimental empathy-induction, $F(1, 2001) = 13.70$, $p < .001$, $\eta^2 = .01$, in that participants report higher vaccination intention when the empathy-eliciting text was provided (*M* = 5.68, *SD* = 1.71) compared to when this was not the case (*M* = 5.38, *SD* = 1.93; Cohen's *d* = 0.22). We did not find a significant interaction between herd immunity and empathy, $F(1, 2001) = 0.97$, $p = .33$, $\eta^2 < .01$. These results indicate that herd immunity and empathy have independent and additive effects on the motivation to get vaccinated. We discuss the implications of these important findings in the discussion section below.

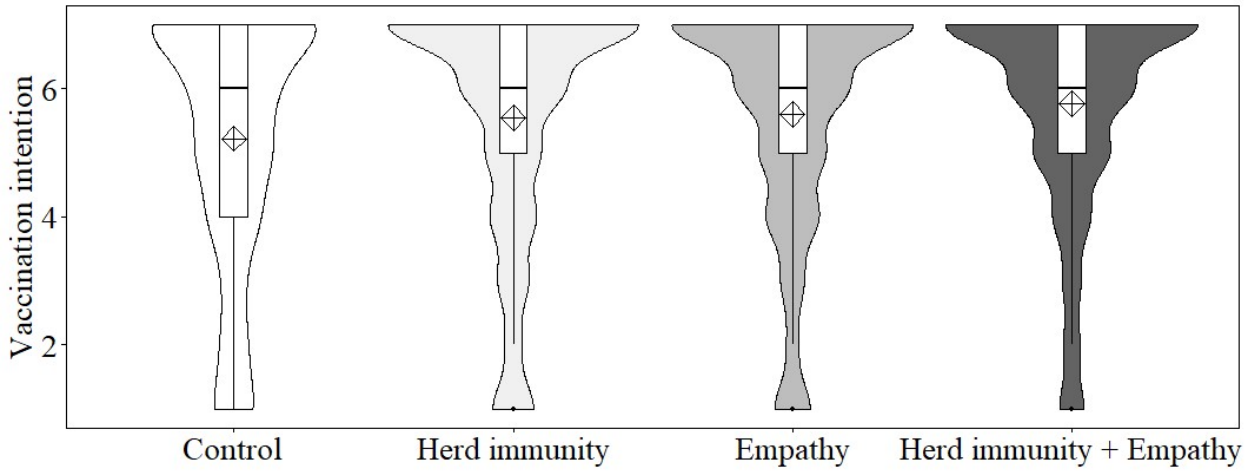

Figure 1. Vaccination intention (1–7) depending on the experimental conditions (Study 2). The vertical box indicates the interquartile range from the 25th to the 75th percentile, including the median (line) and the mean value (diamond); the shaded areas indicate the density of observations.

Next, we tested whether higher levels of state empathy are directly related to participants' vaccination intention. In fact, state empathy was positively correlated with vaccination intention across conditions, $r = .23$, $p < .001$. That is, with higher levels of state empathy, the intention to get vaccinated increased. We further tested two indirect effect models to test whether state empathy explains the effect of the experimental conditions on intention. Controlling for state empathy significantly attenuated the effect of the experimental empathy-induction on vaccination

intention (model 1 includes empathy vs. no empathy, 95% CI indirect effect [0.05, 0.14]). In contrast, state empathy did not significantly attenuate the effect of the herd immunity condition (model 2 includes herd immunity vs. no herd immunity, 95% CI indirect effect [-0.04, 0.03]; see OSF for detailed reporting of the indirect effect models). As such, these process analyses further support the conclusion that state empathy drives the effect of the experimental empathy-induction (but not the effect of the information about herd immunity) on the intention to get vaccinated against COVID-19.

Finally, we tested whether the experimental conditions altered participants' subjective own vulnerability and their subjective perception of the vulnerability of others. Detailed reporting of the findings, including means, *SD*s, and test statistics can be found on the OSF (https://osf.io/4395f/). We found that the experimental empathy-induction slightly increased participants' subjective own vulnerability, $F(1, 2001) = 20.04$, $p = .006$, $\eta^2 = .004$, but not the perception of others' vulnerability, $F(1, 2001) = 2.86$, $p = .091$, $\eta^2 = .00$. No other significant main or interaction effects were found. Subjective vulnerability was positively correlated with vaccination intention (self: $r = .25$, $p < .001$; other: $r = .32$, $p < .001$), and those being objectively more vulnerable (being in the risk group) had a higher vaccination intention ($M = 5.74$, $SD = 1.76$) than those not in the risk group ($M = 5.49$, $SD = 1.83$), $t(2003) = 2.30$, $p = .022$, Cohen's $d = 0.14$. The indirect effect models involving state empathy reported in the paragraph above remained robust when subjective vulnerability (self and other) were controlled for. In addition, none of the vulnerability measures (objective and subjective vulnerability) significantly moderated the effect of empathy and herd immunity on the vaccination to get vaccinated.

These findings indicate that, although the experimental empathy-induction (slightly) increased participants' subjective own vulnerability, and the finding that objective and subjective vulnerability (self and other) related to participants' vaccination intention, providing information about herd immunity and inducing empathy for vulnerable others had independent effects on the intention to get vaccinated above and beyond objective vulnerability and subjective vulnerability perceptions.

General discussion

The present investigation has four major findings. First, information about herd immunity matters: With increasing knowledge about and beliefs in herd immunity, the intention to vaccinate against COVID-19 increased. Second, we can also *use* information about herd immunity to increase vaccination intention. Third, empathy for those most vulnerable to the virus represents an emotional basis regarding the intention to get vaccinated against COVID-19. Fourth, we can actually *use* empathy to promote people's vaccination intention.

The present research has important policy implications. Specifically, in the effort to reach high numbers of people getting vaccinated against COVID-19 once a vaccination is available, the present research suggests that a *combination* of informational content and emotional content might be most effective. This is particularly important in light of the significant proportion of people who are hesitant to get vaccinated against COVID-19 (Betsch et al., 2020; Mullen O'Keefe, 2020). In fact, we found two independent additive main effects of herd immunity and empathy, and accordingly, the strongest motivation to get vaccinated was found in the condition where both the informational content (herd immunity) and the emotional content (empathic text) were provided (see Figure 1). As such, when designing interventions and communication materials to promote the motivation to get vaccinated against COVID-19, policymakers should consider combining informational content with emotional content.

The findings of the present studies are remarkable from (at least) four points of view. First, the finding that information about herd immunity and empathy both promote the intention to get vaccinated against COVID-19 is particularly noteworthy given that a significant number of participants either have a very low intention to get vaccinated against COVID-19 or a very strong intention to do so—and who are thus less likely to be influenced by such interventions. Even though these strong motivations exist in the context of a COVID-19 vaccine, and in the context of vaccines in general (de Figueiredo et al., 2020), information about herd immunity and empathy both were nonetheless able to alter (i.e., to promote) vaccination intention. In this regard, we contribute to the existing literature by showing that providing information about both herd immunity and empathy can increase vaccination intention even when low or very high motivation exists in a significant number of people.

Second, when changing intentions (and attitudes) in an emotionally loaded and high-stake context—such as whether or not one should get vaccinated during a pandemic—reactance is always a risk. Reactance occurs when people believe that their freedom or control is threatened

or reduced (Brehm, 1966; Rosenberg & Siegel, 2018). Advising people what to do (via information about herd immunity) or "manipulating" their emotional state (such as empathy) could potentially alter people's perception of their own freedom or control, bearing the risk of reactance—and ultimately the reduced intention to get vaccinated. For instance, such psychological reactance has been shown to occur when mandating vaccination (Betsch & Böhm, 2016; Sprengholz & Betsch, 2020). Even though reactance was a risk in our studies, we show that information about herd immunity and empathy can, nonetheless, increase overall intention to get vaccinated. As such, the present findings are noteworthy from a perspective of reactance.

Third, the present work relates to previous work that conceptualized vaccination as a prosocial act (Bauch & Earn, 2004; Betsch et al., 2013; Böhm et al, 2016; Chapman et al., 2012) and to research on prosociality more generally (Batson, 2011). Specifically, it has been shown that prosocial traits are related to individual vaccine uptake (Böhm et al., 2016); information about the prosocial consequences of one's one vaccination increase vaccination intention (Betsch et al., 2017); and a lack of collective responsibility is considered to be one driver of vaccine hesitancy (Betsch et al., 2019). Given the findings of the present research that empathy promotes the intention to get vaccinated, it is possible that part of the previously established effects on the prosocial nature of vaccinations are driven by empathy. These are, however, post hoc speculations that need further empirical examination. For instance, it will be of interest to investigate the generalizability of both interventions (mere information and empathy-induction). Arguably, the present findings are also of interest for other domains of prosocial behavior in which the prosocial nature of the decision task may be not intuitive to all people (as in the case of vaccination; climate change mitigation could be an example here).

Fourth, the findings are also noteworthy from the perspective of research on empathy. The present work (i) extends classic work on empathy and shows that empathy also reveals its prosocial impact in a high-stakes situation of getting vaccinated during a pandemic, (ii) shows that empathy can work in conjunction with providing mere information, in that emotion and information supporting (rather than inhibiting) each other's positive effects on vaccination intention, and (iii) offers some of the largest preregistered experiments testing the effect of empathy on prosocial tendencies (cf. the meta-analysis by McAuliffe et al., 2020).

Limitations

In discussing the findings, we do want to acknowledge limitations of the present research and point to future directions. First, we want to mention that the present work remains silent on

whether pure psychological altruism (i.e., the *ultimate* goal to increase the welfare of another individual; Batson et al., 2002) underlies the shown effects of empathy in the present work. Although previous research by Batson and colleagues has ruled out several egoistic explanations, concluding that empathy is a genuine altruistic emotion (for an overview, see Batson, 2011), we cannot in the present study rule out potential egoistic explanations, such as the desire to develop a good reputation or to avoid social sanctions. Second, we want to acknowledge that the observed effect sizes in the experimental study were small. We argue, however, that small effect sizes matter in the context of a pandemic (cf. Funder & Ozer, 2019). Third, we did measure vaccination intention instead of real vaccination behavior. Although intentions may not perfectly match behavior, it is the best proxy available in a situation where a vaccine does not yet exist. We furthermore want to acknowledge that the two studies were conducted in a Western country only, and that the samples were not representative of the entire population in these countries. The studies were conducted online using self-reports. The intervention (providing information about herd immunity and inducing empathy) was applied and tested on only a short-term scale. As such, it might be useful to replicate the present studies' findings using different stimuli as well as representative samples; to conduct the studies in other (non-)Western countries; and to measure the long-term consequences of providing people with information and the (repeated) induction of empathy.

Conclusion

We argue that these shortcomings do not limit the basic conclusions and the potential of the findings in mitigating the COVID-19 pandemic. In fact, the present research highlights the potential of using information about herd immunity and empathy as a tool to promote the motivation to get vaccinated against COVID-19, and thus to save lives, especially of the most vulnerable members of our societies.

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