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How to convince the vaccine-hesitant? An ease-of-access nudge, but not risk-related information increased Covid vaccination-related behaviors in the unvaccinated

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Abstract

In this study, we contrast how different benefit and harm information formats and the presence or absence of an ease-of-access nudge may facilitate COVID vaccination uptake for a sample of 620 unvaccinated Dutch adults at a timepoint when the vaccine had been widely available for more than a month. Using a 2 × 2 between-subjects factorial design, we varied the information format on mRNA COVID vaccination statistics (generic text vs. facts box) and an affirmative nudge emphasizing the ease of making a vaccination appointment (absent vs. present). We assessed the acceptance of the vaccination information provided, perceptions on the vaccination, and whether participants directly visited a COVID vaccination appointment website. Whereas the facts box did not significantly affect participants' information acceptance, vaccination attitudes, intentions, and link clicking, the affirmative nudge alongside an online link systematically increased the likelihood of clicking on the link to make a vaccination appointment.

A verbal nudge emphasizing the ease of vaccine accessibility is more likely to increase vaccination uptake in an unvaccinated population than informational campaigns on vaccine effectiveness.

KEYWORDS
risk communication, selective information processing, self-efficacy, vaccine hesitancy

INTRODUCTION

Increasing vaccination rates is a key measure for combating and controlling the global COVID pandemic, but it is challenged by the high prevalence of vaccine hesitancy (e.g. Lazarus et al., 2021). While some strategies for persuading the vaccine hesitant have been proposed, prior research has shown that negative expectations and convictions are difficult to change (Giese et al., 2020; Kerr et al., 2022). In this study, we are contrasting different approaches in an unvaccinated sample in order to learn how vaccine hesitancy may be successfully addressed by public health interventions.

Harms and benefit information

One approach for increasing vaccination rates aims to improve the motivation for getting vaccinated by providing information that should positively affect individuals' vaccine perceptions and attitudes (Conner & Sparks, 2005; McEachan et al., 2011; Nehal et al., 2021; Schwarzer, 2008). While collective benefits such as the principle of herd immunity also have the potential to promote vaccination (e.g. Pfattheicher et al., 2022), informing about the personal benefits of the vaccines in terms of preventing infections and hospitalizations (i.e. its effectiveness) in combination with comparatively low harms seems particularly promising (Ashworth et al., 2021; Gates et al., 2021; Motta et al., 2021).

This information provision is transparent when it provides all risk information in absolute numbers for both the benefits and harms and is adjusted to the same denominator (e.g. 10 out of 1000). One way to transparently illustrate both the benefits and harms of a vaccine is a facts box format. A facts box provides absolute risk information on the benefits and harms of a medical intervention, adjusted to the same denominator, for both a control and an intervention group in a tabular format (Brick et al., 2020; Eddy, 1990; McDowell et al., 2016; Schwartz et al., 2007). Such a tabular provision of information has been shown to facilitate both the understanding of the benefit and harm information and the correct recall of both flu and COVID vaccination facts (Brick et al., 2020; Rebitschek et al., 2022).

As a maximally transparent provision of information also fully discloses all given knowledge about the potential harms of a vaccine or treatment, it may not be the most effective approach to motivating skeptical subpopulations (Brewer et al., 2017; Brick et al., 2020; Rebitschek et al., 2022), potentially prompting officials to resort to more generic, non-transparent messaging. Nevertheless, transparent information may be particularly suited to target vaccine-hesitant groups, as it addresses the group's high need for information on vaccination's benefits and harms (Wegwarth et al., 2020) and may thus be perceived as more balanced than mere appeals to rather nontransparent authoritative or normative arguments often resorted to by officials (Giese et al., 2023; Kerr et al., 2022; Petersen et al., 2021; Rebitschek et al., 2022). Thereby, a transparent visual message highlighting both benefits and harms may be best suited to particularly convince both the vaccine hesitant and the people resistant to a vaccination or at least increase their trust in health authorities and social sharing of evidence-based information (Giese et al., 2021; Wegwarth et al., 2017; Wegwarth & Gigerenzer, 2013).

Accessibility of vaccines and vaccine-related information

Motivating unvaccinated people to obtain a vaccination is only a first step toward increasing vaccination rates from a social and health psychology perspective (e.g. Wegwarth et al., 2014). Most health behavior models (such as HAPA or PAPM) argue that motivation is a necessary but insufficient condition for displaying an intended behavior (e.g. Gollwitzer & Sheeran, 2006; Patel, 2021; Schwarzer, 2008; Weinstein et al., 1998). Additionally, executing the desired behavior needs to be facilitated.

One way of increasing people's ability to act on their intentions is to detail out plans for when and how the vaccination could be obtained (Milkman et al., 2011) or prompts reminding people to vaccinate (Jacobson Vann et al., 2018). For instance, Dai et al. (2021) demonstrated in a community setting that sending people a simple text message that reminded them to get vaccinated and contained a link to make a COVID vaccination appointment increased vaccination rates by more than three percentage points.

Yet, indications that these approaches as stand-alone interventions may also be insufficient, particularly for the vaccine-hesitant, can be seen in studies conducted when the vaccine was widely available (Chang et al., 2021). This could have something to do with the difficulties in making an appointment and accessing the vaccinations perceived by these populations (Badr et al., 2021; Eshun-Wilson et al., 2021; Gates et al., 2021). Highlighting the ease of making an appointment and the accessibility of the vaccine, in addition to the link, may thus be sufficient to nudge some of the hesitant to vaccinate. Furthermore, nudging people to make vaccine appointments should, in theory, work best in combination with some promotional informational materials (Weinstein et al., 1998). While the transparent risk information should convince participants to intend a vaccination as a motivational intervention, the ease-of-access nudge may then help to particularly engage these now motivated individuals to directly make a vaccination appointment.

The present study

Therefore, our study assesses how providing detailed, transparent information and an ease-of-access nudge interact to affect vaccination intentions, attitudes, and vaccination-related behaviors in an unvaccinated population. Given that the participants were unvaccinated in the summer of 2021, where the vaccine and its evidence have been widely available for more than a month,[1] we assume that this sample is at least vaccine-hesitant, but we use information on their attitudes, intentions, and background to further understand the demographics of our sample and its COVID vaccine hesitancy. Thereby, this study further contributes to the literature by experimentally testing the effectiveness of the combination of a motivational technique with a nudge to engage a particularly reluctant subpopulation to make COVID vaccination appointments.

Regarding our interventions, we expect that providing more transparent materials will increase the acceptance of vaccine-related information and a positive perception of COVID vaccines relative to providing non-transparent messages. Furthermore, we predict that both using a more transparent information format and providing an ease-of-access nudge highlighting the ease of obtaining a COVID vaccination appointment will increase the likelihood of visiting a website to make such an appointment. In line with general health psychology theories (Weinstein et al., 1998), we further expect these effects to facilitate each other. In addition, we will investigate how prior attitudes toward vaccines and general adherence to COVID guidelines play a role in vaccination decisions and how their impact may be mitigated by the applied interventions. The hypotheses, the design, and the analyses are preregistered under https://osf.io/pn73c.

METHODS

Participants

At the end of July/beginning of August 2021, 1012 self-reportedly unvaccinated Dutch participants were recruited via the platform PanelClix, an ISO 20252-certified Dutch panel provider with more than 100,000 active panelists. In order to be eligible for the study, the participants had to indicate that they had neither had any COVID vaccination sessions nor any vaccination appointments scheduled that they were sure to attend. In addition, they had to confirm not to use a smartphone to answer the questions, and PanelClix ensured all participants were aged 18 years and older. No other quotas were applied. Out of the recruited participants, 620 remained after pre-registered attention-check and seriousness-check screen-outs (age: $M = 45.65$, $SD = 15.75$; 50.6% females; education: $Md = 2$, corresponding to MBO [i.e. Dutch secondary vocational education degree]). Overall, unfinished surveys were independent of information ($\chi^2[1, N = 1040] = .636$, $p = .450$, $\phi = .025$) or ease-of-access nudge condition ($\chi^2[1, N = 1017] = 1.803$, $p = .374$, $\phi = .042$). Similarly, the numbers of screen-outs were independent of the experimental assignment ($\chi^2[3, N = 1012] = 1.097$, $p = .780$, $\phi = .033$).

Design

In this study, we used a 2-information type (nontransparent generic text vs. transparent visual facts box) × 2-ease-of-access nudge (absent vs. present) between-subject design with random assignment of participants to assess the effects of different communication strategies on COVID vaccine acceptance and uptake.

[1]The vaccination roll-out started at the beginning of January 2021, staggered by age. All adults were eligible for a COVID vaccination by June 19, 2021. At the start of this study, more than 90% of all Dutch that have obtained a COVID vaccination until now were at least partially vaccinated (https:\\coronadashboard.government.nl/landelijk/vaccinaties).

For our transparent visual facts box condition of the information type manipulation, we used a translated version of the mRNA COVID vaccination facts box obtained from https://www.hardingcenter.de/en/fact-boxes (at 06-16-21, not accessible anymore; see also Brick et al., 2020 and https://osf.io/wbhxd). This facts box summarizes both information on COVID vaccination benefits and harms in an accessible format by visualizing colored icon arrays indicating the number of COVID cases or vaccine-adverse events for two samples of 1000 vaccinated or unvaccinated individuals in RCT trials. In contrast, the nontransparent format did not include written or visual numeric information or detailed benefit/harm information about COVID vaccination. Here, we used a generic text statement gleaned from a web page of the Dutch National Public Health Institute (RIVM) that translated into: "The BioNTech/Pfizer vaccine has been extensively assessed for efficacy, safety, and quality by the European Medicines Agency (EMA) and the Medicines Evaluation Board (MEB). The vaccine has been tested on tens of thousands of people. (Source: This information comes from the RIVM: https://www.rijksoverheid.nl/onderwerpen/coronavirus-vaccinatie/species-coronavaccins/biontech-pfizer-comirnaty)."

In the ease-of-access nudge condition, the link to the vaccination appointment page was introduced by a translated version of the statement: "Making an appointment for a Corona vaccination is quick and easy; you are now just one click away from an appointment. By clicking on the link http://www.coronavaccinatie-afspraak.nl, you can make an appointment right away." In the absence of the ease-of-access nudge, the same link was offered with a translated version of the statement: "If you want to make an appointment for a Corona vaccination, you can now open the appointment site at http://www.coronavaccinatie-afspraak.nl." The original questionnaire, materials, and further design details are available at https://osf.io/wbhxd.

Procedure

After providing informed consent, participants were screened based on their COVID vaccination status and asked to indicate their attitudes toward vaccinations in general and their vaccination self-efficacy. Participants were then randomized to one of the two information types (nontransparent generic text vs. transparent visual facts box) and asked for their evaluation of the presented message. Subsequently, they were asked to indicate their perception of COVID vaccination benefits and harms, including COVID vaccination attitudes and intentions and social impact ratings. We then presented participants with a link to a national vaccination appointment website with an ease-of-access nudge absent or present. At the end, participants were asked whether we could trust their data and debriefed. We additionally assessed COVID-related risk perceptions, vaccine trial acceptance, and demographics prior to the informational manipulation, with no preregistered hypotheses concerning the presented manipulations.

Measures

Evaluation of the manipulated message

A message acceptance score was computed using six items rating agreement to statements ranging from 1: fully disagree to 7: fully agree ("This information is … understandable, believable, convincing, new to me, trustworthy, informative"; see Giese et al., 2021; reliability for all measures reported in Table 1). Similarly, we assessed whether the message was perceived as a persuasion attempt to get the participant vaccinated. Furthermore, an emotive response to the presented message was assessed with a smiley sheet with five emojis.

Participants' willingness to share the message was assessed by averaging two items ranging from 1: fully disagree to 7: fully agree ("I would share this information with others in my personal communication" and "I would share this information with others in my online communication, via Twitter, Facebook, WhatsApp, etc.", see Giese et al., 2021).

Vaccination attitudes

Both general vaccination attitudes and attitudes toward the COVID vaccination were assessed with a 4-item scale ranging from 1: fully disagree to 7: fully agree ("harmful", "beneficial", "good", "bad"). The scales only differed by their headers ("Generally, vaccinations are…" vs. "Vaccinations against COVID are…"; see Conner & Sparks, 2005; Giese et al., 2020).

Vaccination intentions

Participants' intentions to get vaccinated against COVID were assessed by the mean of three items ranging from 1: fully disagree to 7: fully agree ("I plan to get vaccinated soon.", "I want to get vaccinated soon," and "I will get vaccinated soon"; see Conner & Sparks, 2005; Giese et al., 2020).

Vaccination self-efficacy

Participants' self-efficacy to get vaccinated against COVID was assessed by two items ranging from 1: fully disagree to 7: fully agree ("If I want to, I can easily get vaccinated against Corona.", "It takes a lot of effort to get vaccinated against Corona." (reverse-coded); see Conner & Sparks, 2005).

Adherence to governmental guidelines

Planned adherence to governmental guidelines was assessed by the mean of six items on the same seven-point scale for the upcoming week ("I plan to wash my hands frequently and accurately"; "I plan to keep a distance of 1.5 meters from others"; "I plan to get tested if I have symptoms"; "I plan to stay home if I have symptoms"; "I plan to work from home as much as possible"; "I plan to closely comply with COVID measures"; adapted from de Ridder et al., 2022; de Wit et al., 2022).

Perceptions of harms and benefits

Participants reported their risk perceptions and perceived vaccination benefits on the same 7-point scale (see Giese et al., 2020; Renner & Reuter, 2012). For risks of a COVID infection and

TABLE 1 Correlations and descriptive statistics of vaccine perceptions.

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Message acceptance	−0.01	0.18	.81	.34**	−.19**	.53**	.61**	.42**	.07	.39**	.40**	.59**	−.31**	.37**	.02
2. Willingness to share	−0.26	0.24	-	.77	−.15**	.25**	.27**	.31**	.07	.11**	.17**	.23**	−.13**	.23**	−.11**
3. Message stance	0.22	0.26	-	-	-	−.18**	−.25**	−.22**	−.02	−.11**	−.14**	−.18**	.17**	−.22**	.08
4. Emotive response	−0.13	0.26	-	-	-	-	.54**	.44**	.01	.34**	.32**	.49**	−.35**	.31**	.02
5. Vac. attitude COVID	−0.12	0.23	-	-	-	-	.93	.57**	.01	.65**	.39**	.70**	−.54**	.39**	.04
6. Vac. intention	−0.33	0.23	-	-	-	-	-	0.98	.11**	.33**	.35**	.55**	−.34**	.37**	−.08*
7. Website visit	0.04		-	-	-	-	-	-	-	−.01	−.01	.04	−.10*	−.02	.00
8. Vac. attitude gen.	−0.02	0.25	-	-	-	-	-	-	-	.94	.25**	.50**	−.37**	.22**	.10*
9. Adherence guidelines	0.08	0.26	-	-	-	-	-	-	-	-	.89	.40**	−.09*	.65**	.02
10. Vaccine benefits	−0.13	0.26	-	-	-	-	-	-	-	-	-	.81	−.31**	.47**	.01
11. VAE risk perception	0.19	0.22	-	-	-	-	-	-	-	-	-	-	.84	−.06	−.04
12. COVID risk perception	−0.06	0.23	-	-	-	-	-	-	-	-	-	-	-	.79	−.09*
13. Vac. self-efficacy	0.29	0.21	-	-	-	-	-	-	-	-	-	-	-	-	.65
14. Vac. info	0.20	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-
15. Social responsibility	−0.20	0.27	-	-	-	-	-	-	-	-	-	-	-	-	-
16. Trust in institutions	−0.12	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: The table shows the reliability (Cronbach αs) of scales on the diagonals of the correlation matrix (except for one-item measures) and their correlations with demographic variables and risk perceptions. For computing means and standard deviations, all continuous scales were normalized to a symmetrical range from −0.50 to +0.50, with 0 being the scale midpoint and the range reflecting the potential scale range. Underlined values pertain to associations discussed in the results.

Abbreviations: Coll. edu., college education; Cons., conservatism; Pol. extr., political extremism; Vac., vaccine; VAE, vaccine adverse events.

*$p < .05$.

**$p < .01$.

TABLE 1 (Continued)

	14	15	16	COVID sick	Cons.	Pol. extr.	Age	Gender	Coll. edu.	No religion	Work	Dutch
1. Message acceptance	−.13**	.59**	.58**	.00	−.10*	−.16**	−.21**	−.03	.01	−.09*	.00	−.06
2. Willingness to share	−.04	.32**	.26**	.02	−.07	−.12**	−.10*	.01	.02	−.05	.00	−.15**
3. Message stance	.11**	−.24**	−.17**	−.03	.07	.10**	.20**	.08*	.05	.02	−.05	.02
4. Emotive response	−.17**	.48**	.48**	.04	−.13**	−.14**	−.23**	−.02	.05	.04	.04	−.10*
5. Vac. attitude COVID	−.21**	.69**	.60**	.03	−.14**	−.16**	−.26**	.06	.12**	.02	.10*	−.03
6. Vac. intention	−.15**	.63**	.49**	.03	−.18**	−.16**	−.19**	.04	.07	.02	.12**	−.06
7. Website visit	−.04	.05	.03	−.01	.00	.02	.00	.14**	−.03	−.01	.04	−.04
8. Vac. attitude gen.	−.13**	.42**	.38**	−.07	−.10*	−.13**	−.19**	.02	.19**	.13**	.10*	.04
9. Adherence guidelines	−.10*	.43**	.64**	.04	−.18**	−.20**	.01	−.14**	.00	−.10*	−.05	−.04
10. Vaccine benefits	−.18**	.70**	.58**	.07	−.12**	−.16**	−.13**	.05	.07	.00	.04	.01
11. VAE risk perception	.17**	−.36**	−.31**	−.03	.12**	.03	.17**	−.11**	−.08*	−.09*	−.14**	−.04
12. COVID risk perception	−.21**	.45**	.53**	.00	−.13**	−.21**	−.02	−.06	−.03	−.18**	−.02	−.07
13. Vac. self-efficacy	.21**	−.03	.00	−.13**	.07	.04	−.07	−.04	.08	.00	.04	.03
14. Vac. info	-	−.25**	−.13**	−.09*	.03	.11**	.18**	−.03	−.06	−.01	−.03	.04
15. Social responsibility	-	.92	.66**	.08*	−.13**	−.13**	−.19**	.03	.05	−.03	.05	−.08*
16. Trust in institutions	-	-	.76	.03	−.14**	−.20**	−.12**	−.03	.03	−.04	.00	−.04

Note: The table shows the reliability (Cronbach αs) of scales on the diagonals of the correlation matrix (except for one-item measures) and their correlations with demographic variables and risk perceptions. For computing means and standard deviations, all continuous scales were normalized to a symmetrical range from −0.50 to +0.50, with 0 being the scale midpoint and the range reflecting the potential scale range. Underlined values pertain to associations discussed in the results.

Abbreviations: Coll. edu., college education; Cons., conservatism; Pol. extr., political extremism; Vac., vaccine; VAE, vaccine adverse events.

*$p < .05$.**$p < .01$.

COVID vaccine adverse events, we averaged subjective likelihood ("The chances of me getting COVID at a certain moment are high."/"If I would get vaccinated, chances of me having a side effect are severe."), severity ("COVID is a serious disease."/"Side effects of the vaccination are worse than the effects of COVID."), and affective risk perception ("I am worried about/feel threatened by COVID/side effects of the vaccination."). Regarding the benefits of the COVID vaccine, we asked participants to rate their agreement on two statements ("The COVID vaccination will protect me against a COVID infection." and "The COVID vaccination will protect me from severe effects of a COVID infection.") on the same scale.

Furthermore, we assessed the subjective level of information with one item ("I am well informed about COVID vaccinations") on the same 7-point scale.

Ratings of societal impact

We assessed felt social responsibility with the mean of two items ranging from 1: fully disagree to 7: fully agree ("I can protect others by getting vaccinated against COVID." and "Getting vaccinated against COVID is good for the society."; adapted from https://www.rivm.nl/en/coronavirus-covid-19/research/behaviour).

In addition, we assessed trust in Dutch governmental institutions with two items ("I trust the COVID recommendations by organizations like RIVM." and "I follow the COVID recommendations from organizations like RIVM."; adapted from https://www.rivm.nl/en/coronavirus-covid-19/research/behaviour) on the same 7-point scale.

Participants also reported their political ideology on a 7-point scale from 1: very left to 7: very right. This value was centered around the scale midpoint and squared to compute political extremity (e.g. Spinde et al., 2022).

Statistical analysis

We first provide descriptive statistics of the study population and some exploratory correlates of the study variables with demographical information. To enable a better interpretation of scales, all scales were normalized to a symmetrical range from −0.50 to +0.50, with 0 being the scale midpoint. Higher values indicate agreement with (message stance as a persuasion attempt in favor of the vaccine), more positive (attitudes and emotive responses), or higher expression of the construct (vaccination self-efficacy, message acceptance, willingness to share, vaccination intention, guideline adherence, COVID infection risks, vaccine adverse event risk, vaccine benefits, subjective level of information, felt social responsibility, trust in institutions).

To test how information type affected both message evaluations and general vaccination perceptions, we implemented two MANOVAs, one for each construct, as preregistered. For the effects of general vaccination attitudes and adherence to guidelines on the information type manipulation, we used a GLM extension of the same model by entering these continuous variables as predictors (centered around the scale midpoint; i.e. not recoded) in addition to the 2 information type conditions (generic text vs. visual facts box) of the between-subject factor, as preregistered. Significant interactions were followed up by testing effects for extreme positive (+0.50) or negative (−0.50) general vaccination attitudes or adherence, or by simple effects analyses when this continuous variable was not part of the analysis.

For the likelihood of clicking on the link to the vaccination website, we used two effect-coded between-subject factors: 2-information type conditions (generic text vs. visual facts box) × 2-ease-of-access nudge conditions (absent/present) in a logistic regression. Effects of both adherence to COVID guidelines and general vaccination attitude and their interaction with information type were also included in the final logistic regression model in order to determine whether the manipulation was differentially affecting participants with other preconditions. To compute odds-ratio comparisons between the two nudge conditions, a dummy-coded version of the logistic regression ensued the effect-coded analysis.

In line with the preregistration, no corrections for multiple comparisons were applied for the three main outcomes because the vaccination appointment website visits were the only outcome potentially affected by the ease-of-access nudge manipulation, the MANOVA estimates information type effects across different outcomes as the central test of inference, and we did not want to inflate errors in favor of the null hypothesis for information type. All these analyses were preregistered with the hypotheses and design of the study (https://osf.io/pn73c), and all planned sample sizes were based on a power-analysis assuming small effects for main or interaction effects with one degree of freedom in an ANOVA ($f = .10$) with a power of .80 (Faul et al., 2007). For the final, achieved sample size, sensitivity analyses (power = .80; $\alpha = .05$; Faul et al., 2007) indicated that small effects with a size of $f = 0.11$ could be reliably detected for all effects in question.

RESULTS

Demography and anti-vaccine attitudes

Because our sample only contained unvaccinated people at a time when the vaccine was generally available for more than a month, participants held a skeptical attitude toward vaccines in general that was not clearly distinguishable from the scale midpoint ($M = -0.02$, $t(619) = -1.78$, $p = .076$, $d = -0.07$) and 83.2% of the sample indicated no intention to get vaccinated against Covid in the near future ($M = -0.33$, $t(619) = -36.50$, $p < .001$, $d = -1.47$). While participants mostly held negative attitudes toward the COVID vaccine ($M = -0.12$, vs. general attitude: $t(619) = -12.88$, $p < .001$, $d = -.432$), the general and COVID vaccine attitudes were highly positively correlated, as shown in Table 1. This illustrates that—while perceptions of the COVID vaccine are linked to general vaccine acceptance—participants distinguished between them, and their stronger objections to the COVID vaccine did not fully generalize to vaccines in general. At the time of our investigation, 15% of the sample population indicated that they had already contracted COVID, and 39% indicated having experienced cases within their family.

As further replications of general health behavior models (e.g. Gutiérrez-Doña et al., 2012; Schwarzer, 2008), more positive vaccination attitudes were associated with stronger vaccination intentions, higher perceived COVID risks, higher vaccine efficacy, and lower levels of perceived risks of the vaccine (Table 1).

With regards to demographical characteristics, older and less educated individuals held less favorable views toward vaccines (potentially reflecting the age-staggered vaccination roll-out and our sampling restrictions to the unvaccinated, specifically selecting the few old people that were still unvaccinated and particularly skeptical of the vaccine), while there was no association with gender or an individual's personal experience with COVID infections (Table 1). Our sample also replicated the notion that conservatism and more extreme political viewpoints are associated with a more negative stance toward the COVID vaccination (e.g. Giese et al., 2023; Rebitschek et al., 2022) and other COVID containment measures (Wegwarth et al., 2020). Overall, members of our sample regarded themselves as rather well informed about the COVID vaccine ($M = 0.20$, $t(619) = 20.33$, $p < .001$, $d = 0.81$).

Intervention effects

Message evaluations

In contrast to our expectations, the evaluations of the information remained unaffected by the two variants of information type (Pillai's trace $V = 0.04$, $F(4, 615) = 0.66$, $p = .623$, $\eta^2_p = .004$; univariate: all $F(1, 616) \leq 1.31$, all $p \geq .252$, all $\eta^2_p \leq .002$). This means that the provision of transparent visual information did not improve the acceptance of the information overall, the willingness to share it, the perception of purpose, or the emotive response compared to a generic statement.

While all measures rating the message were largely affected by general vaccination attitudes, its interaction with the information type intervention mostly yielded no significant effects (Table 2). Only the negative emotive response of people with a general negative attitude was slightly less pronounced after being provided a visual facts box compared with a generic text (Table 2). However, we do not regard this result as meaningful due to the fact that the MANOVA yielded no significant effect. The same pattern of results—both generally and regarding the emotive response—also held for the relationship between planning to adhere to COVID recommendations and rating the informational messages (Table 1; information type × adherence: Pillai's trace $V = 0.16$, $F(4, 613) = 2.49$, $p = .042$, $\eta^2_p = .016$; effect for emotive response: $F(1, 616) = 5.75$, $p = .017$, $\eta^2_p = .009$; rest: $F(1, 616) \leq 2.35$, $p \geq .126$, $\eta^2_p \leq .004$).

Vaccination perceptions

Again disconfirming our expectations, all vaccination-related perceptions remained unaffected by our variations of information type (Pillai's trace $V = 0.03$, $F(7, 612) = 0.27$, $p = .965$, $\eta^2_p = .003$; univariate: all $F(1, 618) \leq 0.98$, all $p \geq .322$, all $\eta^2_p \leq .002$). In addition, while all vaccination-related perception measures were largely affected by general vaccination attitude, the interaction of general vaccination attitude with information type also yielded no significant effects (Table 2). Although COVID vaccination attitudes, intentions to vaccinate against COVID, perceived vaccine effectiveness, feeling social responsibility, and trust in institutions were positively associated with more positive general vaccination attitudes and these general attitudes were negatively associated with the risk perception of vaccine adverse events and viewing oneself as informed (Table 1), none of these measures were significantly affected by the information type provided. The same pattern of relationships was also observed for participants' adherence to public COVID recommendations (Table 1; information type × adherence: Pillai's trace $V = 0.10$, $F(7, 610) = 1.44$, $p = .187$, $\eta^2_p = .016$; univariate: all $F(1, 616) \leq 2.98$, all $p \geq .085$, all $\eta^2_p \leq .005$).

TABLE 2 Experimental effects of information type and effects of general vaccination attitudes on rating outcomes.

	Information type					Attitude			Attitude × information type		
	Text	Visual									
	M (SD)	M (SD)	F	p	$\eta_{partial}^2$	F	p	$\eta_{partial}^2$	F	p	$\eta_{partial}^2$
Message evaluations overall	-	-	**.65**	**.626**	**.004**	**33.97**	**<.001**	**.181**	**1.63**	**.165**	**.011**
Message acceptance	−0.01 (.18)	−0.01 (.18)	.00	.975	.000	113.18	<.001	.155	.278	.598	.000
Message stance	−0.26 (.24)	−0.27 (.23)	1.38	.241	.002	7.20	.007	.012	.051	.821	.000
Willingness to share	0.23 (.24)	0.21 (.27)	.58	.445	.001	7.32	.007	.012	.864	.353	.001
Emotive response	−0.14 (.27)	−0.13 (.25)	.30	.587	.000	80.83	<.001	.116	5.76	.017	.009
Vaccination perceptions overall	-	-	**0.25**	**.971**	**.003**	**67.49**	**<.001**	**.436**	**0.89**	**.513**	**.010**
Vaccination attitude COVID	−0.12 (.23)	−0.13 (.23)	.160	.690	.000	453.22	<.001	.424	.02	.903	.000
Vaccination intentions	−0.33 (.23)	−0.34 (.22)	.170	.680	.000	76.85	<.001	.111	.37	.541	.001
Vaccine effectiveness	−0.12 (.26)	−0.15 (.26)	.758	.384	.001	205.33	<.001	.250	.41	.521	.001
VAE risk percpetion	0.19 (.21)	0.19 (.22)	.069	.794	.000	95.41	<.001	.134	2.32	.128	.004
Vaccination info.	0.20 (.25)	0.21 (.24)	.090	.764	.000	9.73	.002	.016	.07	.785	.000
Social responsibility	−0.20 (.27)	−0.21 (.26)	.145	.703	.000	130.13	<.001	.174	.41	.524	.001
Trust in institutions	−0.13 (.26)	−0.12 (.26)	.162	.688	.000	103.91	<.001	.144	.44	.509	.001

Note: This table reports information type effects conditional on general vaccination attitude equaling 0 in the model (including all three terms). This deviates from the reported statistics in the text for information type, where attitude and interaction are not controlled. The means and standard deviations of the two conditions are not controlled for attitude. The overall effects (in bold) are derived from MANOVA-type analyses.

Vaccination appointment website visits

Not surprisingly, the unvaccinated subpopulation assessed in this study was reluctant to follow a link to a website for making an appointment for a COVID vaccination: only 25 out of 620 participants (4%) clicked on the corresponding link. In analogy to the absence of effects based on information type, we detected no meaningful differences in likelihood to click the link to the website for COVID vaccines, regardless of whether it was provided together with the generic text or the visual facts box (Table 3). This likelihood was also not significantly affected by the interaction of information type × nudge (Table 3). Similarly, general vaccination attitudes (Table 3) were not significantly associated with the decision to click on the link, nor was this association significantly mitigated by the provision of different types of information (Table 3). The same was true for adherence to COVID measures (Table 3). In short, these findings violate our expectation that information type, COVID-related attitudes, or adherence to corresponding measures are associated with the likelihood of seeking online information on COVID vaccinations.

However, and in line with our expectations, a large effect emerged for the ease-of-access nudge manipulation (Table 3). Compared with participants of the nudge absent condition to whom the ease of getting vaccinated was not emphasized, participants of the nudge present condition were more than three times as likely to click the link to the vaccination appointment website (Figure 1; recoded contrast between groups: $b = 1.17$, $p = .014$, $OR = 3.21$, 95% CI [1.26; 8.18]). Note, however, that due to the low baseline of clicks, this large relative effect corresponds to an uncontrolled absolute effect of 4.2 percentage points (an increase from 1.9% clicks without the nudge to 6.1% with the nudge; Figure 1; controlled for covariates and estimated from the logistic regression, the difference is 1.9% vs. 5.9%).

Exploratory analysis of the appointment website visits

Of all participant attributes regarding vaccines and COVID-related characteristics (i.e. not considering the message), the individuals who clicked on the link to the appointment website only marginally tended to have a higher intention to receive the vaccine ($M = -0.21$ vs. $M = -0.34$,

TABLE 3 Experimental effects on the likelihood of clicking on the vaccination appointment website link in a logistic regression model.

							OR 95% CI	
Estimate	***b***	***S.E.***	**Wald**	***df***	***p***	**OR**	**LL**	**UL**
Information type (−1 visual/+1 text)	.129	.257	.252	1	.615	1.138	.688	1.881
Nudge (−1 absent/+1 present)	.584	.238	5.991	1	.014	1.792	1.123	2.860
Information type × nudge	−.010	.238	.002	1	.965	.990	.620	1.579
Adherence	−.176	.835	.044	1	.833	.839	.163	4.311
Information type × adherence	−1.172	.835	1.969	1	.161	.310	.060	1.592
Attitude	−.346	.860	.162	1	.687	.708	.131	3.816
Attitude × information type	.432	.860	.252	1	.616	1.540	.286	8.302
Constant	−3.360	.257	171.477	1	<.001	.035		

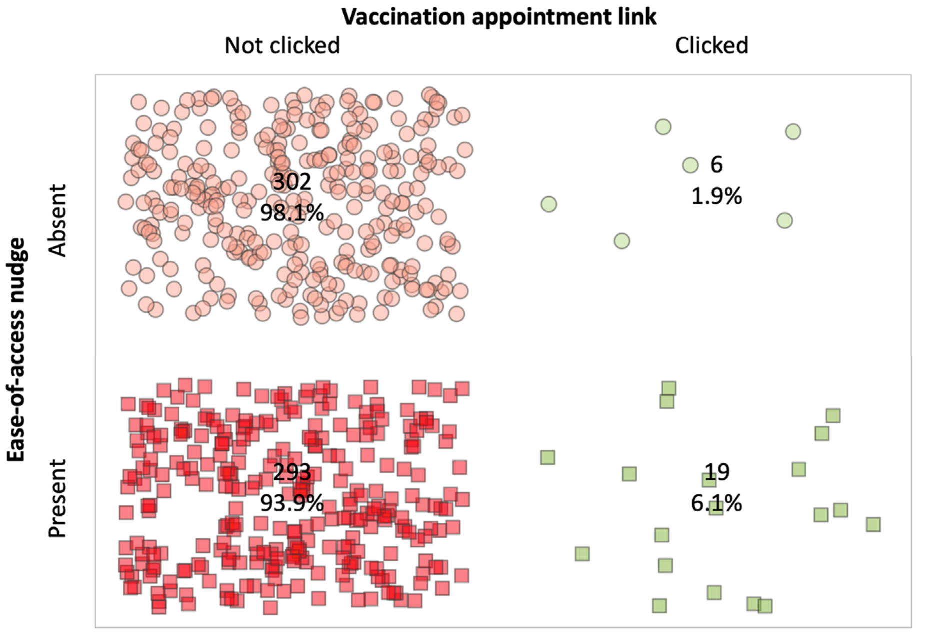

FIGURE 1 Effects of the ease-of-access nudge on the number of clicks for visiting a site that allowed making vaccination appointments. The numbers in the graph note the absolute frequencies of cases (upper number) and the corresponding proportion of participants (lower number) who did or did not click on a link to a website that allowed making a vaccination appointment by ease-of-access nudge condition. The link was clicked about three times as often (6.1% vs. 1.9%) when accompanied by an affirmative nudge that emphasized the ease of making an appointment.

$t(24.89) = 0.937$, $p = .074$, $d = .556$) and had lower vaccine adverse event risk perceptions ($M = 0.09$ vs. $M = 0.19$, $t(25.46) = -2.09$, $p = .047$, $d = -.498$). Notably, among the other attributes, prior self-efficacy of being able to receive the vaccine did not play a significant role ($M = 0.29$ vs. $M = 0.29$, $t(26.95) = 0.31$, $p = .976$, $d = .005$; also Table 1). However, because of the low number of people clicking on the link and not correcting for multiple comparisons, these explorative, not preregistered effects are rather tentative.

DISCUSSION

This study tested how manipulations of information type and an ease-of-access nudge affected unvaccinated individuals' perceptions of COVID vaccines and their willingness to visit a website to make a vaccination appointment. While the ease-of-access nudge—or highlighting the ease of making an appointment—increased the likelihood of visiting an appointment website, the variation of information type yielded no systematic effects.

Because we used a sufficiently large sample and a large battery of different measures, the lack of an information type effect—even when not accounting for the many comparisons testing these differences—is not attributable to a lack of power but rather indicates an existing null effect in our sample. Therefore, the facts box format with all its visuals and transparent display of vaccine efficacy and safety was neither more accepted by our unvaccinated population than the nontransparent generic recommendation statement nor did it affect the perception and evaluation of the vaccine. This negative finding contrasts with more promising findings of these materials in generic populations (e.g. Petersen et al., 2021; Rebitschek et al., 2022). On the positive side, our findings also suggest that the transparent information is not misinterpreted by a vaccine-hesitant population as evidence against the vaccination.

One potential explanation why the more transparent information format was ineffective in changing both our participants' ratings of the materials and their perceptions is that, at the time of the study, the rather vaccination-hesitant subpopulation studied may already have decided not to get vaccinated and was no longer willing to consider new information on the matter (Gollwitzer & Sheeran, 2006; Weinstein et al., 1998). Overall, participants perceived themselves as aware of the facts about COVID vaccines and dismissed the vaccine regardless of the contradicting scientific evidence presented to them. This interpretation is corroborated by low vaccination intentions and a high self-perceived level of information regarding the topic. The information materials and potentially the questions on vaccination evidence prior to the materials were apparently insufficient to open the participants' minds to reevaluate their position on vaccinations (see also Giese et al., 2023).

In contrast to the null effect of the informational part of our intervention, the simple and small intervention of an ease-of-access nudge that emphasized the ease of accessing a website for making a vaccination appointment showed a relatively large effect, albeit on a very low level of overall engagement. This finding may reflect that—in the context of the study—there existed perceived barriers to vaccination that could be alleviated by directly addressing them in a short verbal statement. As such, it seems that promoting the vaccine by the ease of its accessibility rather than by informational campaigns may be the more promising way to approach the unvaccinated. It is curious and potentially encouraging that—despite a lack of interest in vaccination-related information and in the absence of an intention to get vaccinated—people in our unvaccinated sample could be motivated to visit the vaccination appointment page based on such a simple verbal nudge.

Some caveats constrain the generality and interpretation of our results. First of all, as our sample was limited to unvaccinated individuals, our findings may not generalize to a general population that includes less hesitant groups. For instance, a more representative and vaccine-favorable population may be more responsive to informational campaigns than a vaccine-hesitant and resistant sample (Giese et al., 2020, 2021). Thus, our study measured the impact of informational materials in a particularly difficult environment and may thus underestimate their general effects on increases in acceptability. Similarly, Dai et al. (2021) showed that targeting people via text messages could be more effective than online delivery because text messages compete less for attention with other information. Finally, although the external validity of measuring visits to the appointment website is supported by its positive relationship to vaccination intentions, visiting the appointment website does not guarantee a subsequent vaccination. Likewise, the other measures, even though used in prior research, had to be adjusted to reflect the specific circumstances of the COVID vaccination—a practice common in health psychology, but leaving some aspects of the measures unvalidated.

In conclusion, a very brief ease-of-access nudge emphasizing the ease and accessibility of COVID vaccines managed to convince a small but substantial part of an unvaccinated subpopulation to visit a site to make a vaccination appointment. Ironically, this simple nudge neither required more elaborate benefits and harms information nor an intention to vaccinate in order to be functional. While the low overall response rate for this behavior also highlights the limitations of this approach, having the vaccine readily available to the unvaccinated and emphasizing the ease of its accessibility may thus provide a cost-effective intervention strategy to address unvaccinated subpopulations.

CONFLICT OF INTEREST STATEMENT

Wolfgang Gaissmaier has received honoraria for lecturing/consulting from Amgen, Bayer, Biogen, Celgene, Genzyme, Merck Serono, MSD, Mundipharma, Novartis Pharma, Roche, Sanofi, and Teva, as well as research support from Biogen.

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DATA AVAILABILITY STATEMENT

The study materials and the data that support the findings of this study are openly available on osf at https://osf.io/wbhxd. For further details and additional information, please contact the corresponding author. This study has been pre-registered under https://osf.io/pn73c.

ETHICS STATEMENT

The study was approved by the University of Konstanz ethics board and the ethical committee of the Faculty of Social and Behavioural Sciences of Utrecht University (#21–320).

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