




“Using framing and nudging to increase COVID-19 vaccine willingness: An experimental study”

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ARTICLE INFO	Robert Schorn, Verena Christl and Kathrin Oberhofer (2024). Using framing and nudging to increase COVID-19 vaccine willingness: An experimental study. <i>Innovative Marketing</i> , 20(4), 158-167. doi: 10.21511/im.20(4).2024.14
DOI	http://dx.doi.org/10.21511/im.20(4).2024.14
RELEASED ON	Monday, 09 December 2024
RECEIVED ON	Sunday, 22 September 2024
ACCEPTED ON	Monday, 11 November 2024
LICENSE	 This work is licensed under a Creative Commons Attribution 4.0 International License
JOURNAL	"Innovative Marketing "
ISSN PRINT	1814-2427
ISSN ONLINE	1816-6326
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

41



NUMBER OF FIGURES

0



NUMBER OF TABLES

2

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BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine
www.businessperspectives.org

Received on: 22nd of September, 2023
Accepted on: 11th of November, 2024
Published on: 9th of December, 2024

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Conflict of interest statement:
Author(s) reported no conflict of interest

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USING FRAMING AND NUDGING TO INCREASE COVID-19 VACCINE WILLINGNESS: AN EXPERIMENTAL STUDY

Abstract

Many people are hesitant or unwilling to take advantage of potentially life-saving vaccines; this is true even in a global pandemic and even when vaccines are readily available and/or free. Apart from general unwillingness to be vaccinated, fear of side effects is a frequently named reason for vaccine hesitation. This survey-based study, carried out online in Austria in March of 2021, examines the efficacy of two different approaches – framing and nudging – in promoting a fictional COVID-19 vaccine program. While nudging had no visible effects, either positive or negative, framing was associated with more positive feelings toward the campaign and a greater intention to be vaccinated, though only among those already pre-disposed to get the vaccine. Governments and healthcare organizations are eager to find low-cost measures to increase vaccination rates for COVID-19 and other diseases. This study's results suggest that addressing and positively framing the high likelihood of problem-free vaccinations should form an integral part of public messages, but that this approach may be ineffective among those who are strongly hesitant or unwilling.

Keywords

nudging, framing, consumer persuasion, vaccination, COVID-19

JEL Classification

M31, M37, I12

INTRODUCTION

Many people fail to take advantage of potentially life-saving vaccinations. In Austria, for instance, where 83% of adults report a (mostly) positive attitude toward vaccination in general, the rate of immunization against e.g., influenza (10% in the 2018/19 season) is still one of the lowest in Europe (Österreichischer Verband der Impfstoffhersteller [ÖVIH], 2019). If boosting vaccine rates is important with seasonal air-borne illnesses such as flu, this is doubly true in a situation such as the world experienced with COVID-19 beginning in 2020. Certain low-cost measures, such as nudging or framing in public health messaging, have shown promise in the promotion of other vaccines against more familiar seasonal diseases such as influenza. The present study explores whether these measures can also be effective in the midst of a global pandemic – with a disease that was comparatively unfamiliar – that was not only massive in size and in impact but also omnipresent in the media and in public messaging.

Compared to the low flu vaccination rates described above, uptake of the COVID-19 vaccine in Austria at the time of this study (March, 2021, one year into the pandemic) was far higher: by the end of May 2021, just under half of those aged 16 and older had received at least

their first dose (Pollak et al., 2021)¹. Reported willingness to be vaccinated rose continually from 32% in October and December of 2020 (before a vaccine was available) to 68% in May of 2021 (this percentage includes those who had already received at least one dose). The percentage of those who stated that they did not intend to be vaccinated fell from 46% to 22% in the same period (Paul et al., 2021). The same panel survey found high follow-through among those who had reported their intent to be vaccinated; conversely, those opposed showed consistently low vaccination rates across age and risk groups (Ennsner-Jedenastik et al., 2021), suggesting that objective risk factors such as age or pre-existing health conditions did not lead to higher vaccination rates within this group. Depending on the disease and the development of mutations, estimates put the percentage of people that must be vaccinated to achieve herd immunity between 70% and 90% of a total population (McNeil, 2021 [2020]) (total population includes those not eligible for vaccination, e.g. children), which means that even the lower rates of vaccine refusal seemed alarming in a situation such as the COVID-19 pandemic.

A Gallup poll in Austria found the highest refusal rates occurred in respondents under age 50, particularly the 31-50 age bracket (Gallup Institut, 2021; for similar data for Italy, see Gori et al., 2023). Among the vaccine hesitants, the most frequently given reasons were doubts about the efficacy of a COVID-19 vaccine (69%), general mistrust of the pharmaceutical industry (70%), and fear of side effects (87%) (Gallup Institut, 2020; for similar data for Germany, see e.g. Haug et al., 2021). This last factor was reflected in the way intention to be vaccinated differed widely depending on the specific vaccine and its perceived risk of side effects: in March 2021, the percentage of people who stated they would probably turn down the chance to be vaccinated was 17% for the BioNTech/Pfizer vaccine but 49% for AstraZeneca (Eberl et al., 2021). These figures tally with research that finds concerns about and overestimation of vaccine side effects to be a major reason for vaccine hesitancy (Altay & Mercier, 2020; Betsch & Wicker, 2012; Kantorowicz-Reznichenko et al., 2022; Omer et al., 2009).

1. LITERATURE REVIEW

Previous research has explored different low-cost measures from the behavioral sciences that encourage the uptake of various health measures, including disseminating and reinforcing information (often framing this information in a certain way); nudging, prompting or defaulting people into a certain behavior; and lowering thresholds to action or removing real-world obstacles. In the work focusing on the promotion of vaccine uptake, the aims of most such measures can be put into two broad categories: influencing intention (i.e., persuading or reassuring people that they want and intend to be vaccinated) and facilitating action (i.e., getting people to actually follow through on their intentions) (Brewer et al., 2017). Prompts and nudges that have proved effective in increasing influenza immunization include: reminding high-risk patients by text message that they

are eligible for a free vaccine and asking them to schedule an appointment (Regan et al., 2017); sending text messages prior to a primary care visit reminding patients to get their flu shot, particularly if these messages indicated that a dose of the vaccine had been ‘reserved’ or ‘was waiting’ for the patient (Milkman et al., 2022; Milkman et al., 2021); prompting employees of a large firm to write down the provided date and time for a jab within their workplace free clinic’s opening hours (i.e. forming implementation intentions) (Milkman et al., 2011); or presenting vaccination appointments as a given with the option to cancel or reschedule rather than making patients opt in (i.e. defaulting) (Chapman et al., 2010).

Public messaging and framing information are another tool in influencing vaccination intentions. In general, negatively framed information is judged to be truer than positively framed in-

¹ The first COVID-19 cases in Austria were officially registered in late February of 2020. The World Health Organization officially declared a pandemic on March 11, 2020, and Austria went into the first of several lockdowns on March 16, 2020. Vaccines first became available in late December of 2020, and the speed of vaccination picked up noticeably starting in March 2021. However, doses were largely allocated by priority groups (e.g. risk factors, age, profession), and due to supply shortages, by the start of July 2021 many preregistered people (younger adults in particular) were still waiting for doses to become available and supply had just barely begun to outstrip demand in some provinces (Krutzler, 2021; n.a., 2021).

formation (Fessler et al., 2014), but in the case of medical treatments, positive framing (e.g., giving survival rather than mortality rates) leads to a more positive attitude towards these treatments (Altay & Mercier, 2020). However, the effect of positive/gain framing on prevention behaviors appear to be far weaker for vaccines than e.g. for cancer prevention, smoking cessation or safer sex (Gallagher & Updegraff, 2012). Moreover, positive framing may only be effective in boosting compliance among those who see themselves as more likely to be negatively affected by a disease, such as the elderly or the more susceptible (Biroli et al., 2020). It is also important to note that overly positive news media messaging may actually create distrust and a sense of coercion and may engender resistance in those already hesitant (Ashwell & Murray, 2020; Krutzler, 2021; n.a., 2021). In terms of messaging and framing in public health messages promoting vaccine uptake for airborne diseases (e.g., flu, H1N1), a review of 35 studies found that messages including information about virus risks and vaccine safety were more likely to increase willingness/uptake (Lawes-Wickwar et al., 2021; Johansen et al., 2023).

Other measure types have proved not only more costly but also risky: Financial compensation may not only lower intrinsic motivation to take a particular action but can also inadvertently signal a particular action is undesirable or risky (Cryder et al., 2010). In the case of the COVID-19 vaccine, this type of incentive was shown to backfire, particularly if the offered compensation was too low (Serra-Garcia & Szech, 2023). In contrast, the small chance of a large real-world financial gain, such as the vaccine lotteries carried out in many US states in 2021, did boost first-dose uptake, but had no or even negative effects on complete vaccinations, as the incentive applied only to getting the first dose (Fuller et al., 2022).

Seasonal influenza and COVID-19 are both drop-let/fomite-spread and potentially deadly respiratory diseases, but the perception of the two diseases differs strongly, and findings from studies on the promotion of vaccine uptake for, e.g., flu may therefore not apply to the kind of global pandemic the world experienced in the early 2020s. COVID-19 was – and in many ways, still is – new and unfamiliar. Boosted by its high saliency and

constant presence in the media, particularly in the first year of the pandemic, COVID was more likely to be seen as a clear and present danger to a greater number of people: more contagious, more deadly and having more adverse effects both in the short and long term. All of this should make people more likely to avail themselves of protective measures such as vaccines. However, COVID-19 vaccines were equally new and unfamiliar and were also fairly rapidly developed; they were therefore more likely to be perceived as unproven and potentially less effective or less safe than older and more familiar vaccines, and even those normally trusting of vaccines were hesitant (Lunz-Trujillo & Motta, 2021). The intense public scrutiny of any side effects that occurred in vaccine trial and roll-out only increased the perception of risk.

The research specifically on COVID-19 vaccination behavior found that defaulting increased the uptake of COVID testing and the self-reported intention to be vaccinated in the early stages of the pandemic (Serra-Garcia & Szech, 2023). Text prompts (including a link for easy appointment booking) sent to high-risk patients or the elderly soon after they received notification of vaccine eligibility was found to boost real-world uptake (Dai et al., 2021; Lee et al., 2024), particularly if the text included a message of psychological ownership (Dai et al., 2021). The findings on the effectiveness of public health messaging in promoting COVID-19 vaccination are mixed and often differ depending on the messages' content: Messages providing detailed information on the vaccine development process (Kerr et al., 2021; Motta et al., 2021), emphasizing the economic costs of not vaccinating against COVID-19 (Motta et al., 2021) or describing the horror and suffering of a death from COVID (Kantorowicz-Reznichenko et al., 2022) did not affect intention to be vaccinated. Positively framed messages emphasizing others' intention to be vaccinated (e.g. "... the vast majority of people in [country] stated that they would get a COVID-19 vaccine ...") were found to be both effective (Palm et al., 2021) and without effect (Kantorowicz-Reznichenko et al., 2022). Messages emphasizing the safety and efficacy of a (future) vaccine were found effective in some studies (Barnes et al., 2023; Palm et al., 2021) but had no effect on intention to vaccinate oneself (Barbosa et al., 2024, Study 1) or one's children

(Tan et al., 2024) in others. In one study, positive framing of information on vaccine side effects was found to increase vaccination intention for less familiar vaccines, but that the opposite was true for more familiar vaccines (Barnes & Colagiuri, 2022). Messages on the personal health risks (i.e., the risk of becoming seriously ill) and the collective public health consequences (risk of infecting others) of not getting the vaccine were found to be effective in boosting vaccination intention, but far less so among those already skeptical about vaccine safety (Motta et al., 2021).

The study set out to explore the impact of nudging and framing on attitude towards a (fictional) COVID-19 vaccination campaign one year into the pandemic, hypothesizing that both devices would positively affect respondents' feelings towards the campaign and their intention to be vaccinated.

2. METHODOLOGY

In an online survey carried out in Austria in March of 2021, participants ($n = 204$) provided sociodemographic data, answered three questions (4-point Likert scale) on their general attitude towards vaccination, read a short text vignette, and then answered several questions (11-point Likert scale) in reaction to this text. They were randomly assigned to one of four conditions (2x2 between-participants design, see Table 1). Vignettes all began with an identical introduction telling respondents to imagine that the government was planning special "vaccination days" as part of a free COVID-19 vaccination program and giving a date for their vaccination ("Your vaccination will take

place on Friday of next week"). In the no-nudge condition, the text stated that participants would have until the day before the appointment to decide whether they wanted to be vaccinated; the nudging condition made no mention of any such option. Next, the vignettes either stated that, according to studies, the vaccine in question had had no side effects in 99% of patients (positive framing), or that 1% of patients had experienced side effects (negative framing).

3. RESULTS

The respondents ($n = 204$) were recruited from among students and staff at UMIT university (Tyrol, Austria), through the researchers' private contacts and via social media. They were between 18 and 64 years old ($M = 30.7$, $SD = 11.56$); 124 (61%) identified as female, 80 (39%) as male. All participants had completed (or were in the last stages of completing) vocational training or upper secondary school; 71 also held at least one tertiary degree. Before reading the vignettes, 79.4% expressed a (mostly) positive attitude towards vaccines in general ("I generally feel positive towards vaccination", Att-1) and 74.5% towards COVID-19 vaccines ("I generally feel positive towards the COVID-19 vaccination", Att-2). 48.5% said they would definitely, and 27.9% probably get the COVID-19 vaccine ("I would get vaccinated against COVID-19", Att-3), with only 23% saying they would probably or definitely not.

In terms of participant response to the text vignette on the fictional vaccination program, a two-way ANOVA (see Table 2 for results and

Table 1. 2x2 group design with wording of text vignettes

Introductory sentences for all conditions Imagine that the government is planning a free COVID-19 vaccination program due to the Corona pandemic. As part of this program, there will be special "vaccination days". Your vaccination will take place on Friday of next week.			
Condition	Wording	Nudging	Framing
1	Recent studies have found that the vaccine being used does not cause any side effects in 99% of patients.	+	+
2	You have until Thursday of next week to decide whether you want to be vaccinated on Friday. Recent studies have found that the vaccine being used does not cause any side effects in 99% of patients.	-	+
3	Recent studies have found that the vaccine being used causes side effects in 1% of patients.	+	-
4	You have until Thursday of next week to decide whether you want to be vaccinated on Friday. Recent studies have found that the vaccine being used causes side effects in 1% of patients.	-	-

item wording) found no interaction effect between conditions (nudging and framing) and no significant main effect for nudging on any of the questions. Neither framing nor nudging caused participants to feel more uneasy about the fictional vaccination measures (Q7), wary/mistrustful of the vaccination program (Q6), pressured by the announcement (Q5), or limited in their freedom to choose (Q4). In contrast, framing had a significant main effect on two aspects: positive framing was associated with greater happiness at the opportunity to receive the vaccine (Q3) and with a higher intention to get vaccinated (Q2). However, separate analyses found that the main effect of framing on both these questions was present only among those ($n = 156$) who had professed an intention to be vaccinated against COVID-19 (yes, probably yes) before reading the vignettes but not among those who said they would (probably) not get vaccinated ($n = 47$).

A separate analysis for women and men found that both genders expressed similar attitudes towards vaccination in general (Att-1; female: $M = 3.23$, $SD = 0.83$; male: $M = 3.19$, $SD = 0.76$) but

women were significantly less positive in their attitude towards the COVID-19 vaccine (Att-2; female: $M = 2.98$, $SD = 0.94$; male: $M = 3.26$, $SD = 0.79$; $t(202) = -2.201$, $p = .029$, Cohen's $d = 0.3$, small effect size). Even so, both genders expressed a similar willingness to get the COVID-19 vaccination themselves (Att-3; female: $M = 3.17$, $SD = 1.01$; male: $M = 3.27$, $SD = 0.81$) before reading the text vignette. This gender-separated analysis also found that the influence of positive framing on the professed intention to get the vaccine on the day proposed (Q2) was higher among men ($M_{[pos_fram]} = 8.71$ vs. $M_{[neg_fram]} = 5.13$, $F[1,78] = 27.186$, $p < .001$, $\eta_p^2 = .258$, large effect size) than among women ($M_{[pos_fram]} = 6.99$ vs. $M_{[neg_fram]} = 5.77$, $F[1,122] = 4.413$, $p = .038$, $\eta_p^2 = .035$, small to moderate effect size). The same was true concerning participants' happiness at the opportunity to receive the vaccine (Q3): men $M_{[pos_fram]} = 8.74$ vs. $M_{[neg_fram]} = 5.11$, $F[1,78] = 26.403$, $p < .001$, $\eta_p^2 = .253$, large effect size; women: no significant effect for framing. While framing had no impact on women's feeling uneasy about the fictional measures (Q7), there was a significant effect among men ($M_{[pos_fram]} = 3.74$, $M_{[neg_fram]} = 5.02$, $F[1,78] = 4.205$, $p = .044$, $\eta_p^2 = .051$).

Table 2. Item wording and results of the two-way ANOVA

Q no	Item eng	Interaction	ME nudging	ME framing	F	Effect size η_p^2	Positive framing	Negative framing
Q2	I will definitely get vaccinated on the date mentioned.	.419	.498	< .001	$F[1,200] = 21.75$	.098 medium	$M = 7.58$, $SD = 3.28$	$M = 5.49$, $SD = 3.10$
Q2 - sep	within $n = 156$ who said (pre-survey) they would probably/definitely get vaccinated against COVID-19 (Att-3)	.454	.620	< .001	$F[1,152] = 25.15$	.142 large	$M = 8.45$, $SD = 2.76$	$M = 6.03$, $SD = 3.21$
Q2 - sep	within $n = 47$ who said (pre-survey) they would probably/definitely NOT get vaccinated against COVID-19 (Att-3)	.470	.324	.885			$M = 4.00$, $SD = 2.81$	$M = 3.96$, $SD = 2.26$
Q3	I am glad to have this opportunity to get vaccinated.	.586	.528	< .001	$F[1,200] = 19.6$	.089 medium	$M = 7.67$, $SD = 3.10$	$M = 5.67$, $SD = 3.29$
Q3 - sep	within $n = 156$ who said (pre-survey) they would probably/definitely get vaccinated against COVID-19 (Att-3)	.617	.582	< .001	$F[1,152] = 20.83$	.121 medium-large	$M = 8.55$, $SD = 2.56$	$M = 6.36$, $SD = 3.33$
Q3 - sep	within $n = 47$ who said (pre-survey) they would probably/definitely NOT get vaccinated against COVID-19 (Att-3)	.480	.399	.570			$M = 4.05$, $SD = 2.46$	$M = 3.70$, $SD = 2.35$
Q4	I feel that these measures restrict my freedom to choose.	.377	.406	.64				
Q5	I feel pressured by this announcement.	.684	.264	.243				
Q6	I feel wary/mistrustful of this vaccination program.	.761	.643	.780				
Q7	These measures make me feel uneasy.	1	.916	.085				

4. DISCUSSION

Previous research has explored low-cost measures (among them framing and nudging) in encouraging the uptake of various health measures, including vaccination against communicable diseases like influenza. To our knowledge, the present study was one of the first to use both nudging and framing in the same experiment on adult vaccine uptake, and the first to do so for COVID-19.

In contrast to most previous work on flu and COVID-19 vaccines (e.g., Chapman et al., 2010; Dai et al., 2021; Lee et al., 2024; Milkman et al., 2011; Milkman et al., 2022; Milkman et al., 2021; Serra-Garcia & Szech, 2023), in the present study nudging (here: defaulting participants into an appointment and not mentioning the option to decide for or against getting vaccinated) had no visible effect on participants' intention to be vaccinated. While surprising, this may be because the present study was based on a fictional vaccination program and therefore did not entail real-world vaccination appointments: At the time of the survey (March 2021) many of the respondents were not yet eligible to receive the vaccine due to government-mandated priority-based dose allocation. In fact, it was only in the summer of that same year that the supply of COVID-19 vaccines began to outstrip demand in parts of Austria (Krutzler, 2021; n.a., 2021). Nudging, prompting, defaulting etc. work mainly by helping people who are generally willing to do something overcome inertia, distraction, or forgetfulness, particularly if paired with measures to minimize real-world obstacles and inconvenience (e.g., providing easy scheduling options) – this did not apply here. On a positive note, however, nudging had no undesired negative effects, such as creating feelings of unease, mistrust, or coercion, meaning none of those measures intended to promote vaccine uptake inadvertently accomplished the opposite.

Similar to previous research (e.g., Altay & Mercier, 2020; Johansen et al., 2023; Lawes-Wickwar et al., 2021), positive framing (focusing on the 99% of vaccine recipients who had experienced no side effects rather than on the 1% who had) had beneficial effects, making respondents feel happier about the opportunity to receive the vaccine and increasing their professed intention to be vaccinated them-

selves. The strength of this effect may be due in particular to the nature of the disease in question and the nature of the information in the messaging, namely, that the framing in this study happened to target the most frequently named reason for COVID-19 vaccine hesitation: fear of negative side-effects (see, e.g., Altay & Mercier, 2020; Betsch & Wicker, 2012; Kantorowicz-Reznichenko et al., 2022; Omer et al., 2009). However, a closer analysis showed that the boost in intention to be vaccinated and happiness at the opportunity was only present in those who had been (somewhat) positively disposed towards the COVID-19 vaccine, but that positive framing had no effect on those who stated beforehand that they would (probably) not get the vaccine. This may indicate that prior attitudes toward vaccination are the most relevant factor in vaccine willingness (Barbosa et al., 2024) and suggests that, in a nutshell, framing or other positive messaging may only work on those predisposed to be convinced or swayed (Motta et al., 2021), but may be ineffective in persuading those who are very hesitant or unwilling from the outset. For this latter group, finding ways to change prior attitudes toward vaccination in general may be “a more promising avenue of intervention” (Barbosa et al., 2024).

The study is, of course, based on a fictional campaign, and there was no opportunity to directly observe real-world follow-through, particularly since many of the participants had still not become eligible for a vaccine three months after the initial survey. Even so, the results provide a good indication that framing is an effective tool to sway or reinforce vaccine willingness in those who are positively predisposed towards receiving a vaccine. Literature on the promotion of vaccine uptake suggests that, in general, “focusing on mobilizing people who already intend to get vaccinated [...] may be more effective than focusing on changing intentions” (Dai et al., 2021), and the study provides evidence that positive framing of salient reasons for hesitancy is an effective tool for achieving this end. However, allaying fears, influencing attitude or reinforcing positive intentions may, on their own, still not be enough to boost vaccination rates, even among the willing: As previous research has shown, defaulting and nudging can increase actual uptake, and reducing real-world obstacles and inconveniences is also important in getting those who are willing to be vaccinated to follow through on their intentions.

CONCLUSION

In the summer of 2021, a few months after the present survey took place, supply of COVID-19 vaccines was only just beginning to outstrip demand in Austria, and it was only later that all those who wanted to be vaccinated could be or had been. This paper has provided evidence that, in the midst of a global pandemic, the framing of health messaging can be an effective tool in influencing intentions among those not generally opposed to receiving a new and still unfamiliar vaccine; results also indicate that such messaging may be most effective when it focuses on those concerns – in the case of COVID-19, the fear of side effects – that are the leading causes for vaccine hesitancy. However, the present study also finds that positive framing may not be effective in influencing the intentions of those who are opposed or very hesitant from the outset; reaching and persuading this holdout group is likely to require different types of messaging or different instruments altogether. Future research should therefore continue to target means of persuading the hesitant and unwilling, or preventing people from becoming part of this group in the first place by increasing general trust in vaccines. While means of boosting intention amongst the undecided and promoting action amongst the willing are probably the most efficient and effective tools in stemming the tide of a pandemic such as COVID-19, getting through to those who are not responsive to these approaches may be vital in an epidemic where high vaccination rates are crucial to herd immunity.

AUTHOR CONTRIBUTIONS

Conceptualization: Robert Schorn, Verena Christl.

Data curation: Verena Christl.

Formal analysis: Robert Schorn, Kathrin Oberhofer, Verena Christl.

Investigation: Robert Schorn, Verena Christl.

Methodology: Robert Schorn, Verena Christl.

Project administration: Verena Christl.

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Writing – review & editing: Robert Schorn, Kathrin Oberhofer.

ACKNOWLEDGMENT(S)

Supported by funds from the province of Tyrol.

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APPENDIX

Materials and methods

Participants included psychology students, other students, staff, and faculty of the UMIT TIROL (University for Health Sciences and Health Technology in Hall in Tirol, Austria), plus their friends and families. All were contacted by e-mail and asked to complete an online survey and reminded once ten days later. Participation was voluntary; psychology students were credited with study participant minutes.

Attitude questions (4-point Likert scale: 0 = do not agree ... 4 = fully agree)

- I generally feel positive towards vaccination Att-1
- I generally feel positive towards the COVID-19 vaccination Att-2
- I would get vaccinated against COVID-19 Att-3

Response to text vignette on (fictional) upcoming vaccination program (11-point Likert scale: 0 = do not agree at all ... 10 = strongly agree)

- I will definitely get vaccinated on the date mentioned. Q2
- I am glad to have this opportunity to get vaccinated. Q3
- I feel that these measures restrict my freedom to choose. Q4
- I feel pressured by this announcement. Q5
- I feel wary/mistrustful toward this vaccination program. Q6
- These measures make me feel uneasy. Q7