



Letter to the Editor

The power of choice: Experimental evidence that freedom to choose a vaccine against COVID-19 improves willingness to be vaccinated



ARTICLE INFO

Keywords

Covid-19

Vaccine allocation

Vaccination hesitancy

Ending the COVID-19 pandemic will require rapid and large-scale uptake of vaccines against the disease. The European Commission has authorized three vaccines so far, and first doses have already been delivered and administered across Europe [5]. However, patients cannot usually choose between vaccines, and Dal-Ré, Stephens and Sreeharan [4] argued in their recent letter to the Editor that restricting freedom of choice may increase vaccination hesitancy, threatening uptake and the achievement of herd immunity. To test this assumption, and to equip decision makers to design efficient evidence-based vaccination policies, we conducted an experiment to investigate how vaccine preferences and offers of non-preferred vaccines might affect vaccination intention.

The experiment was conducted on February 23 and 24, 2021, as part of the cross-sectional study series COVID-19 snapshot monitoring (COSMO) [2]. Participants were recruited from a non-probabilistic German sample ($N = 1012$), quota-representative for age \times gender and federal state. Excluding individuals who had already been vaccinated, yielded a final sample of $n = 967$. Participants ranged in age from 18 to 74 years ($M = 45.62$, $SD = 15.66$) and included 483 males and 484 females. All participants gave informed consent prior to data collection, and ethical clearance was obtained from the University of Erfurt's institutional review board (#20200302/20200501).

At the beginning of the experiment, a priori vaccination intention was assessed by asking participants how likely they would get vaccinated against COVID-19 if offered a chance to do so in the following week. Participants responded on a 7-point scale ranging from *not at all likely to get vaccinated* to *definitely getting vaccinated*. Participants were then asked which vaccine they would prefer; response options included *the BioNTech vaccine*, *the AstraZeneca vaccine*, *another vaccine*, *any vaccine*, and *I do not want to be vaccinated*. While the Moderna vaccine had also by then been approved, prior data collection indicated that people had a strong preference for BioNTech and a weak preference for AstraZeneca, with Moderna somewhere in between. On that basis, we chose the most extreme candidates. Indeed, in our study, 46.2% favored the BioNTech vaccine while only 2.3% chose the AstraZeneca vaccine. A further 4.1% wanted to be vaccinated with another vaccine, 29.4% had no preferences and 18.0% did not want to get vaccinated at all.

Only those participants who favored the BioNTech and AstraZeneca vaccines ($n = 469$) were included in the next steps of the experiment.

They were told that they could not choose the vaccine they preferred but would instead be assigned one. Participants were then randomly offered the BioNTech or AstraZeneca vaccine; as a result, about half were assigned their preferred vaccine while the other half were offered the non-preferred vaccine. To further emphasize the restriction of choice, participants were told that the other (non-assigned) vaccine would not be available to them for at least six months. Using four items adapted from the Salzburg State Reactance Scale [9], participants were then asked how angry they felt about this lack of choice; for example, one item asked “How much does it annoy you that you can't choose between vaccines?”. Each answer was recorded on a 7-point scale ranging from *not at all* to *very much*, and scores were averaged to calculate an anger score (Cronbach's $\alpha = 0.95$). Finally, participants were asked how likely they would be to accept the assigned vaccine if offered the opportunity to do so in the following week. Answers were again recorded on a 7-point scale ranging from *not at all likely to get vaccinated* to *definitely getting vaccinated*; scores ≤ 3 were interpreted as tending to reject the vaccine.

Fig. 1A shows that restriction of vaccine choice elicited anger. When assigned the non-preferred vaccine, participants were angrier than when the preferred vaccine was offered, $t(460.5) = 3.56$, $p < .001$. Vaccination intention also differed between the two groups; when assigned their preferred vaccine, only 6% of participants intended to decline vaccination, as compared to 42% in the non-preferred vaccine group. As compared to a priori vaccination intention, willingness to be vaccinated increased when the preferred vaccine was assigned and decreased for the non-preferred vaccine, revealing a significant interaction effect, $F(1934) = 88.86$, $p < .001$ (Fig. 1B). Similar results emerged when participants aged 65 or older (for whom the AstraZeneca vaccine was not officially recommended in Germany) were excluded from the analysis (see online supplement).

The results provide empirical support for the benefits of being able to choose a vaccine, which increases willingness to be vaccinated against COVID-19. This is clearly of particular relevance where strong preferences exist or where a preferred vaccine is scarce. When assigned a non-preferred vaccine, individual vaccination intention is likely to decline dramatically, as observed for example in Germany, where societal sentiment against AstraZeneca emerged in mid-February [6].

<https://doi.org/10.1016/j.ejim.2021.03.015>

Received 26 February 2021; Accepted 12 March 2021

Available online 19 March 2021

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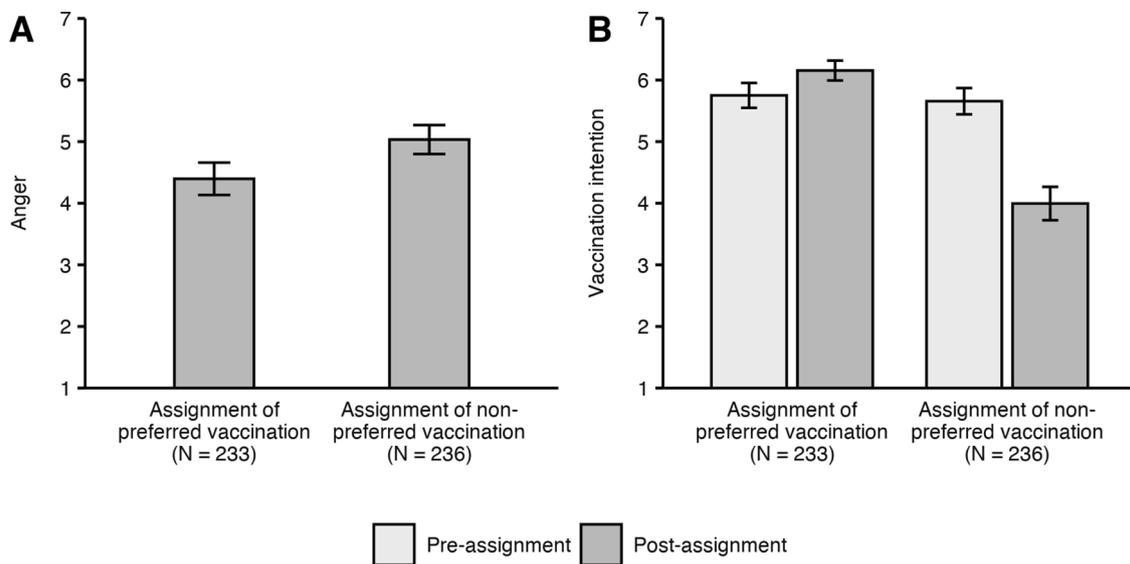


Fig. 1. Anger and vaccination intention following assignment of preferred or non-preferred vaccine
Note: Participants who favored the BioNTech (AstraZeneca) vaccine were randomly assigned the BioNTech (AstraZeneca) vaccine (*assignment of preferred vaccine*) or the AstraZeneca (BioNTech) vaccine (*assignment of non-preferred vaccine*). On average, anger about restriction of choice (A) was higher, and vaccination intention (B) was lower, when the non-preferred vaccine was assigned. Error bars visualize 95% confidence intervals.

These findings should be generalized with caution. The effect of restricting vaccine choice on vaccination intention may differ across countries and may change over time, depending on pandemic conditions and local perceptions of vaccines. In Germany, many people may have taken against the AstraZeneca vaccine because of media reports alleging its lower effectiveness and the potential for adverse events [3]. Enforced assignment may be a more viable strategy when the safety and effectiveness of different vaccines are perceived to differ less. Additionally, the fictitious study scenario and assessment of vaccination intention may not be a perfect representation of real-world vaccine decision-making. Although intention usually predicts behavior [8], there is often a gap between the two, especially where most participants know they will have to wait for months before getting vaccinated.

Despite these limitations, our findings have important implications for policy makers. To improve the situation in Germany, for instance, two strategies might prove useful. Dal-Ré, Stephens and Sreeharan [4] suggested that citizens might be allowed to discuss their vaccine preference with their healthcare provider, and to reject the vaccine offered. Clearly, this would depend on the availability of sufficient supplies and a more flexible vaccine delivery system that allows preregistration of individual vaccine preferences. In Germany, where public demand for the BioNTech vaccine clearly exceeds the available supplies and the government chose to order vaccines from multiple suppliers, this would not be feasible as a standalone strategy. An alternative approach would be to investigate the reasons underpinning vaccine preferences. While media outlets have described each vaccine and its effectiveness as reported in phase III studies, the meaning of *effectiveness* has not been widely explained. For example, it is often (mis)understood that a vaccine reported as 70% effective leaves 30 people in every 100 unprotected, increasing differences in perceived effectiveness and in vaccine preferences. Moreover, it has not been widely communicated that *all* approved vaccines are highly effective against severe disease and death from COVID-19 [1, 7, 10]. It seems likely, then, that effective health communication may help to change attitudes to particular vaccines and to reduce preference strength. In this regard, rebuttal of wrong or outdated information about vaccine safety and effectiveness is crucial. Finally, the reasons for assigning a particular vaccine should be made transparent, as anger may wane when people understand why a free choice cannot be offered, possibly reducing hesitancy in relation to less preferred vaccines. As well as keeping public information up to date and

rebutting false or outdated information, working to ensure vaccine availability will be crucial in combating COVID-19. Ultimately, a free choice strategy might boost vaccination uptake and help to end the pandemic.

Online supplement

Materials, data, and data analysis script can be found at <https://doi.org/10.17605/OSF.IO/2PRTW>

Ethical declaration

Our research obtained ethical clearance from the University of Erfurt's IRB (#20200302/20200501) and all participants provided informed consent prior to data collection.

Author contributions

PS, SE, LK, RS and CB designed the research; PS, SE, LK and RS performed the research; PS planned and performed data analysis; PS wrote the initial draft, which was revised and approved by all authors.

Declaration of Competing Interest

All authors declare that they have no conflict of interest.

Funding

This work was supported by German Research Foundation (BE3970/12–1), Federal Centre for Health Education, Robert Koch Institute, Leibniz Institute of Psychology, Klaus Tschira Stiftung, Thüringer Ministerium für Wirtschaft, Wissenschaft und digitale Gesellschaft, Thüringer Staatskanzlei and University of Erfurt (no award/grant numbers).

Acknowledgments

The study was conducted as part of Germany's COVID-19 Snapshot Monitoring (COSMO), a joint project of the University of Erfurt (Cornelia Betsch [PI], Lars Korn, Philipp Sprengholz, Philipp Schmid, Lisa

Felgendreff, Sarah Eitze), the Robert Koch Institute (RKI; Lothar H. Wieler, Patrick Schmich), the Federal Centre for Health Education (BZgA; Heidrun Thaiss, Freia De Bock), the Leibniz Institute of Psychology (ZPID; Michael Bosnjak), the Science Media Center (SMC; Volker Stollorz), the Bernhard Nocht Institute for Tropical Medicine (BNITM; Michael Ramharter), and the Yale Institute for Global Health (Saad Omer).

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