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The political component of COVID-19 vaccine choice. Results from a conjoint experiment

Abstract

Objectives

Prior research highlights the role of efficacy, vaccine safety, and availability in vaccine hesitancy. Research is needed to better understand the political driving forces behind COVID-19 vaccine uptake. We examine the effects of the origin of a vaccine, and approval status within the EU on vaccine choice. We also test if these effects differ by party affiliation among Hungarians.

Study design

We utilise a conjoint experimental design to assess multiple causal relationships. Respondents choose between two hypothetical vaccine profiles randomly generated from ten attributes. The data were gathered from an online panel in September 2022. We applied a quota for vaccination status and party preference. 324 respondents evaluated 3,888 randomly generated vaccine profiles.

Methods

We analyse the data using an OLS estimator with standard errors clustered across respondents. To further nuance our results, we test for task, profile, and treatment heterogeneity effects.

Results

By origin, respondents prefer German (MM 0.55; 95% CI 0.52– 0.58) and Hungarian (0.55; 0.52 – 0.59) vaccines over US (0.49; 0.45– 0.52) and Chinese vaccines (0.44; 0.41 – 0.47). By approval status, vaccines approved by the EU (0.55, 0.52–0.57) or pending authorization (0.5, 0.48–0.53) are preferred over unauthorised ones (0.45, 0.43–0.47). Both effects are

conditional on party affiliation. Government voters especially prefer Hungarian vaccines (0.6; 0.55 - 0.65) over others.

Conclusions

The complexity of vaccination decisions calls for the usage of information shortcuts. Our findings demonstrate a strong political component which motivates vaccine choice. We demonstrate that politics and ideology have broken into fields of individual-level decisions such as health.

Keywords

COVID-19 vaccines; Vaccination; SARS-CoV-2

Introduction

To make communication on COVID-19 vaccines more efficient and increase vaccination rates, we need more knowledge on what information people take into account in making this complex health decision. This is especially crucial in *countries with multiple vaccine choices*, where information on vaccines is denser, and people are consequently selective of information and often rely on information shortcuts. To answer this call, this study looks at the effect of various vaccine characteristics on COVID-19 vaccine choice in general, and of its political aspects in particular. While vaccination campaigns often are politicised, the political component of COVID-19 vaccine uptake is frequently overlooked.

Concerns regarding efficacy[1–5], side effects[1–4,6–12], vaccine safety,[1,5,7,9–11,13,14] the vaccine's ability to prevent transmission[5,15], and its accessibility[6,16,17] (convenience) are amongst the leading causes of COVID-19 vaccine hesitancy and delay. Multiple vaccine choices and the individual's free choice of vaccine can reduce hesitancy[11,18]. At the same time, the abundance of options may be confusing for individuals who are not competent in making such health decisions in a high-uncertainty environment[19]. Indeed, the spread of misinformation[6,10] and conspiracy theories,[12,14,19,20] inconsistent, complicated, and contradictory information on vaccination[3,6], and the absence of sufficient information[11,12] trump vaccine uptake levels. An important determinant of vaccine uptake is political affiliation, which, people use as an information shortcut in the storm of incomplete and confusing information.

While people mistrust political persuasion,[21] and political polarization of the vaccine debate creates doubts about vaccines in general,[22,23] people increasingly rely on political ideology and party affiliation. Research on COVID-19 vaccine uptake confirms the findings of earlier research on general vaccine acceptance[24–26]: conservative and right-leaning people are more likely to show hesitancy than liberal and left-leaning folks[2,9,21,27–29]. People also listen to political leaders and parties,[21,30] and accept vaccines developed in 'friendly countries'[2,11,30].

By employing an experimental design, we directly compare the effects of vaccines' political characteristics such as (1) the origin of the vaccine and (2) the vaccine's approval by the European Medicines Agency (EMA), to that of the usual suspects of the scholarship. Furthermore, we seek to know if the effects of the vaccine's political features are conditional upon the party affiliation of the respondents. Our study allows us to zoom in on the interplay between politics on the supranational level (in this case, the European Union) and nationalistic tendencies in explaining vaccine choice, which, to our knowledge, makes our empirical approach unique.

For our empirical exercise, we select Hungary as a case. As of July 2022, Hungary was the fourth country in the world regarding confirmed COVID-19 deaths per one million inhabitants[31]. In September 2022, the share of fully vaccinated population (62 %) was around the world average of 61 %, but below the EU average (73 %)[32] and within the lowest quarter of the EU. Six COVID-19 vaccines had been in use: Comirnaty (Pfizer/BioNTech), Spikevax (Moderna), Covidshield (Oxford/AstraZeneca), Janssen (Johnson & Johnson), Sputnik V (Gamalexa), and Covilo (Sinopharm).[33] Vaccines are available free of charge, and people can freely choose between them. From the beginning of the vaccination campaign (December 2020), the right-wing-populist government of Viktor Orbán promoted the emergency use (ahead of EMA approval) and the uptake of the so-called 'Eastern vaccines' (Sputnik V and Covilo) Hungary had a big reserve of. Most of the parliamentary opposition parties expressed scepticism towards the safety and efficacy of the Eastern vaccines or campaigned against all COVID-19 vaccines (Mi Hazánk - Our Homeland)[34]. As a response to the opposition's vocal distrust in the Chinese and Russian vaccines, the government tried to frame the biggest opposition parties as anti-vaxxers[35]. The vaccine issue became politically polarised [36]. Accordingly, we expect that compared to voters of opposition parties, government voters are more likely to pick up an Eastern vaccine or a vaccine that is not approved by the EMA.

Methods

Vaccine choice is a complex decision affected by factors such as efficacy, safety, accessibility or government communication. To assess and compare the role of the usual suspects on vaccine choice this study makes use of a *conjoint experiment* which allows for the estimation of multiple causal effects simultaneously and nonparametrically[37]. Conjoint experiments are based on the idea that choices can be broken down into a set of product (here COVID-19 vaccines) attributes. This method is fruitfully applied in public health studies in estimating the effect of vaccine characteristics on vaccine uptake.[2,38–41] Our questionnaire presents respondents with two hypothetical vaccine profiles (*Vaccine A* and *Vaccine B).* We randomly generate vaccine profiles from ten attributes (Table 1) and do not exclude any combinations of attribute levels from the experiment.

[Insert Table 1 here]

Our main attributes of interest are (1) the country in which the vaccine was developed, and (2) EMA approval. While vaccine profiles in the experiment are hypothetical, we aimed at using attribute levels that are familiar to the respondents. From the pool of countries developing COVID-19 vaccines, we include the USA, a Western European country (Germany), and two Eastern countries (Russia and China). We include a fifth country which – to date – does not have a working vaccine against COVID-19: Hungary. We suspect that voters of the right-wing-populist government are prone to vaccine-nationalism[40] and hence would be more willing to accept a vaccine that was developed in Hungary versus other countries.

When designing the levels for the remaining attributes, we aimed at staying as close to reality as possible. For instance, we relied on openly available sources to scale the vaccine efficacy (i.e. the percentage of cases in which the full dosage prevents serious illness) [42] and cost per dosage attributes. We did not include the value 'Common' in the severe adverse events attribute, because no vaccine could be given the green light that commonly causes severe side effects. The remaining values were adopted from the EMA's documentation of the Comirnaty COVID-19 mRNA vaccine with a slight modification (we excluded the category of 'very common' adverse events) to decrease the number of attribute levels.[43]

Dependent variable – Vaccine choice

After reading the vaccine profiles, respondents answered the following question: *Which of the two vaccines would you accept?* (A or B). We refer to this decision as the '*task'*. 324 respondents performed the task *six times* in September 2022. During the six tasks, we showed each respondent 12 vaccine profiles (two in each task). The number of evaluated vaccines in the study is 324 x 12 = 3,888, out of which 3,846 were unique. For the analysis, we transformed the respondent-level data so that each row in the dataset represents one vaccine profile in the experiment. The dependent variable of our analysis is a 0/1 variable taking 1 if the respondent picked the respective profile in the choice task, and 0 if they did not.

Randomization

We apply two types of randomization in creating the vaccine-pairs. First, we randomly assign attribute levels to vaccine profiles. We do not allow the same vaccine profile to appear within the same task (i.e., respondents always have to choose from two profiles that are different), but, though very unlikely, the same vaccine profile may appear during consecutive tasks. Second, each respondent sees the attributes in a different order. However, the order of the attributes per respondent remains fixed. This restriction on randomization is recommended by Hainmueller et al[37] to ease the 'cognitive burden' on respondents.

Sample representativeness

We did not aim at a representative sample of the Hungarian population. It was essential that there are enough observations in the matrix of two variables: COVID-19 vaccine uptake and party preference. Due to the features of the online panel that we used, the chance that a fully representative sample would have granted us to test the interaction between profile attributes, party preference, and vaccine uptake was very unlikely. We aimed at a sample distribution of 25 % vaccinated government voters, 25 % unvaccinated government voters, 25 % vaccinated opposition voters and 25 % unvaccinated opposition voters. While our results are not generalizable to the entire population of Hungary, such data is eligible to investigate causal relationships between variables in experimental settings[44]. We do not weight the data during the analysis[45], but we do test for heterogeneous treatment effects to check if any of the socio-demographic variables interact with the attribute-effects. Furthermore, we only include voting-age respondents in our sample. Panel members with no party preference we exclude from the data. Compared to a nationally representative sample such as the 2021 wave of the European Social Survey (weighted by PSWEIGHT)[46], our sample is about the same age and religiousness. At the same time, our sample includes slightly more women, is generally more

educated, more well off and more interested in politics (Table 2). Furthermore, the majority of our sample did not have a confirmed COVID-19 infection prior to the data collection (65.7 %), and find it rather unlikely to contract COVID-19 during the following 6 months (Avg = 4.66, 1-11 scale).

[Insert Table 2 here]

Data analysis

With no logical combinations of attribute levels excluded from the experiment, a simple linear regression estimator is unbiased and is considered the Average Marginal Component Effect (AMCE)[37]. We interpret coefficients as the average change in the probability that the respective vaccine is chosen, given that the attribute level in question appears in the profile. Since vaccine profiles are embedded into individual respondents, and each respondent evaluates 12 profiles, we cluster standard errors by respondents. We also report Marginal Means (MM) and interpret them as the mean outcome across all appearances of an attribute level. We discuss task, profile, and heterogeneous treatment effects in the Online Appendix.

Results

Figure 1 shows the results of our main model. We find that all attributes in the experiment have significant (CI: 95 %) effects on vaccine choice. Respondents prefer vaccines that are on a later stage of trial, have rare side effects, that are more efficacious, are inexpensive, require a low number of doses to reach the reported efficacy, are available within a month, and prevent the transmission of the virus. We report the linear regression coefficients and predicted probabilities in the Online Appendix.

[Insert Figure 1 here]

In the whole sample, respondents show a preference toward German (MM 0.55; 95%CI 0.52–0.58) and Hungarian (0.55; 0.52 – 0.59) vaccines in contrast to vaccines from the US (0.49; 0.45– 0.52) and China (0.44; 0.41 – 0.47). They also prefer vaccines that are at advanced stages of EU approval (approved: 0.55, 0.52–0.57; approval pending: 0.5, 0.48–0.53; vaccine not approved: 0.45, 0.43–0.47).

Figure 2(a) visualises the MMs of the vaccine's origin across supporters of the government and opposition parties. We report significant differences between vaccines across voter groups. On the one hand, opposition supporters reject Russian vaccines (0.42; 0.37 - 0.47) over vaccines from the US (0.52; 0.47 - 0.57), Germany (0.59; 0.54 - 0.63), and Hungary (0.52; 0.47 - 0.57). Regarding the Chinese vaccines, they are not that negative: only German vaccines are preferred over Chinese (0.45; 0.4 - 0.5) jabs. On the other hand, counter to our expectation, government voters pick Western vaccines (USA: 0.46; 0.41 - 0.51; Germany: 0.52; 0.48 - 0.56) with the same likelihood as Russian shots (0.5; 0.46 - 0.55). For government supporters, the divide lies not between Western and Eastern vaccines but between vaccines developed in Hungary (0.6; 0.55 - 0.65) vs. others.

[Insert Figure 2 here]

Tapping into vaccine-nationalism, our data indicates that there are several differences between government and opposition voters in how the various attributes affect the choice of the Hungarian vaccine. We report that for opposition voters, the trial phase, the severe side effects, efficacy, and transmission plays a role in choosing the Hungarian jab. Contrarily, in the group of government voters, we do not see such effects. No performance measure seems to affect the choice of the Hungarian vaccine in this group. However, government voters appear to be more price-sensitive, and are less likely to pick the Hungarian vaccine if it costs 10,000 HUF (0.45; 0.39 – 0.59) as opposed to being administered for free (0.65; 0.56 – 0.73). At the same time, government voters take vaccine performance (i.e. trial phase, severe side effects, efficacy and transmission) into account when evaluating the non-Hungarian vaccines.

Concerning the vaccine's EMA approval, we find that both government and opposition supporters prefer vaccines that are approved in the EU, and this preference is stronger for opposition voters (Figure 2(b)). Supporters of opposition parties tend to pick vaccines that are already approved (0.57; 0.54-0.61) over non-approved vaccines (0.44; 0.41-0.47) and those with pending approval (0.49; 0.46-0.52). For government voters, on the other hand, it is already reassuring when a vaccine's approval is in progress (0.52; 0.49-0.55) and are willing to pick such vaccines with the same probability as fully approved vaccines (0.52; 0.49-0.55) over non-authorised ones (0.46; 0.42-0.49).

To pinpoint the interplay between vaccine nationalism and supranational politics, we present the MMs of EU approval across the various levels of vaccine origin and party preference (Figure 3). We find that in the cases of both government and opposition voters, choosing a Western vaccine comes with a preference for EU-approval. Opposition voters are also more likely to accept a Chinese vaccine when it is approved by the EU (Approved: 0.52; 0.43 – 0.62; Not approved: 0.34; 0.25 – 0.44). At the same time, the role of EU-approval is insignificant ($p > 0.05$) in choosing a Russian or Hungarian vaccine for both, government, and opposition voters.

[Insert Figure 3 here]

Robustness

To test the robustness of our results we checked for task (i.e. the order in which the tasks are presented within the survey to the respondent affects the vaccine choice) and profile (i.e. the order in which the profiles are presented within a task affects the vaccine choice) effects. We report no significant effects related to the order of tasks (AMCE 0.001; 95%CI –0.001 – 0.004) and profiles (0.015; –0.039 – 0.069). To identify heterogeneous treatment effects, we include an interaction of the country where the vaccine was developed and EU approval with background information such as age, gender, education, place of residence, income, family status, religiousness, political interest, previous COVID-19 infection, the perceived risk of getting infected, and COVID-19 vaccination status. We find heterogeneous treatment effects in the cases of the highest level of education, place of residence, religiousness, and family status. We discuss all heterogeneous treatment effects in the Online Appendix.

Discussion

Our analyses reveal five main findings on the determinants of vaccine choice. First, the country of origin of a vaccine is a strong determinant of its likelihood of acceptance. Respondents preferred German and Hungarian vaccines to American and Chinese vaccines. Second, a vaccine is more likely to be accepted if it is either already approved by the EU, or at an advanced stage of the approval process. Third, significant differences exist between the vaccine choices of opposition and government voters, on the basis of vaccine origin. Supporters of the ring-wing populist government show a strong preference for Hungarian vaccines over non-Hungarians. This is evidence of vaccine-nationalism, and fits well together with the overall nationalist rhetoric of the Hungarian government.[47] The more left –wing

opposition voters on the other hand, show stronger proclivities towards Western vaccines. Attitudes towards Russian vaccines also differ considerably between the two groups. While opposition voters reject Russian vaccines for Western vaccines, government voters show similar propensities to accept them, compared to vaccines of Western origin. Fourth, while far from rejecting Hungarian vaccines, and contrary to government voters, supporters of opposition parties approach the Hungarian jab with more scepticism. Performance measures play an important role in the decision to accept the vaccine from Hungary. Fifth, we find that a pro-EU sentiment goes together with picking a Western vaccine for both government and opposition voters. For the Russian and Hungarian vaccines, we do not find a significant effect of the EMA approval. This suggests an alignment between the West-East narrative and attitudes towards the EU. At the same time, in the case of the Chinese vaccine we probably witness another mechanism in place. Opposition voters are willing to pick the Chinese vaccine if the EU authority supports it. Here, the EU escapes the West-East narrative and appears as an actor that creates trust in the Chinese vaccine.

Our study is relevant for governments and public health authorities in their efforts to increase vaccine acceptance. It is in each country's best interest that their population is vaccinated with the medically best available vaccine. However, as we show, under heavy political polarization, when political vaccine attributes inform vaccine choice they overshadow medical considerations. People have a tendency to rely on the political information shortcut even if all medical and performance data are at their disposal. Therefore, vaccination campaigns should strictly rely on scientific information on vaccines, and be organized by medical authorities using politically neutral language. A larger emphasis should be placed on vaccine features such as efficacy, side effects, or information on transmission instead of its country of origin. In other words, vaccination campaigns should always be grounded in science and not in politics. Politicians, if they participate in vaccination campaigns, should only communicate certified medical information, and avoid transferring existing political polarization into the realm of health decisions. Our results are particularly useful to countries with (1) strong political polarization, or (2) free vaccine choice from a wide array of vaccines in their efforts to calibrate vaccination campaigns. Furthermore, research on vaccine-nationalism could inform countries on whether they should invest in developing their own vaccine to boost vaccine uptake, or is it more efficient to rely on already available shots.

Limitations and next steps

This study is a single-country exercise. Generalizability may be limited to countries with multiple vaccine choices and a highly polarised political scene. At the time of study, about 6.45 million Hungarian people[33] were vaccinated, 8,036 new cases registered weekly, and 35 weekly deaths, according to government services report. While new COVID-19 cases are on the rise, we are still in-between waves. We suspect that in the midst of a serious wave, vaccination decisions might depend more on factors such as efficacy and availability. It is possible that when the threat of infection is not imminent, political aspects could play a larger role. Additionally, we suspect that results for Russian vaccines in the study may have been influenced by the on-going Russia-Ukraine war, and might not be a true reflection of the actual evaluation of the respondents of the vaccine.

Our approach could benefit from replicating the study on a large, representative sample to identify demographic cohorts which are more prone to rely on political heuristics in making health decisions. Public heath campaigns could target these cohorts to help them make decisions grounded in medical information.

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Ethical approval

The study received formal approval from the Institutional Ethics Review Board at the Centre for Social Sciences, Budapest.

Conflict of interest

The authors declare no conflict of interest.

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Data availability

The data underlying this article are available in Figshare, at https://figshare.com/s/0e3dbaf82f4a62c6db7b

References

1. Wong LP, Alias H, Wong PF, Lee HY, AbuBakar S. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. *Hum Vaccines Immunother*. 2020;16(9):2204-2214. doi:10.1080/21645515.2020.1790279

2. Kreps S, Prasad S, Brownstein JS, et al. Factors Associated With US Adults' Likelihood of Accepting COVID-19 Vaccination. *JAMA Netw Open*. 2020;3(10):e2025594. doi:10.1001/jamanetworkopen.2020.25594

3. Soares P, Rocha JV, Moniz M, et al. Factors Associated with COVID-19 Vaccine Hesitancy. *Vaccines*. 2021;9(3):300. doi:10.3390/vaccines9030300

4. Cooper S, van Rooyen H, Wiysonge CS. COVID-19 vaccine hesitancy in South Africa: how can we maximize uptake of COVID-19 vaccines? *Expert Rev Vaccines*. 2021;20(8):921-933. doi:10.1080/14760584.2021.1949291

5. Yahia AIO, Alshahrani AM, Alsulmi WGH, et al. Determinants of COVID-19 vaccine acceptance and hesitancy: a cross-sectional study in Saudi Arabia. *Hum Vaccines Immunother*. 2021;17(11):4015-4020. doi:10.1080/21645515.2021.1950506

6. Machingaidze S, Wiysonge CS. Understanding COVID-19 vaccine hesitancy. *Nat Med*. 2021;27(8):1338-1339. doi:10.1038/s41591-021-01459-7

7. Dror AA, Eisenbach N, Taiber S, et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. *Eur J Epidemiol*. 2020;35(8):775-779. doi:10.1007/s10654-020-00671-y

8. Robertson E, Reeve KS, Niedzwiedz CL, et al. Predictors of COVID-19 vaccine hesitancy in the UK household longitudinal study. *Brain Behav Immun*. 2021;94:41-50. doi:10.1016/j.bbi.2021.03.008

9. Callaghan T, Moghtaderi A, Lueck JA, et al. Correlates and disparities of intention to vaccinate against COVID-19. *Soc Sci Med*. 2021;272:113638. doi:10.1016/j.socscimed.2020.113638

10. Dhama K, Sharun K, Tiwari R, et al. COVID-19 vaccine hesitancy – reasons and solutions to achieve a successful global vaccination campaign to tackle the ongoing pandemic. *Hum Vaccines Immunother*. 2021;17(10):3495-3499. doi:10.1080/21645515.2021.1926183

11. Bolatov AK, Seisembekov TZ, Askarova AZh, Pavalkis D. Barriers to COVID-19 vaccination among medical students in Kazakhstan: development, validation, and use of a new COVID-19 Vaccine Hesitancy Scale. *Hum Vaccines Immunother*. 2021;17(12):4982-4992. doi:10.1080/21645515.2021.1982280

12. Chaudhary FA, Ahmad B, Khalid MD, Fazal A, Javaid MM, Butt DQ. Factors influencing COVID-19 vaccine hesitancy and acceptance among the Pakistani population. *Hum Vaccines Immunother*. 2021;17(10):3365-3370. doi:10.1080/21645515.2021.1944743

13. Paul E, Steptoe A, Fancourt D. Attitudes towards vaccines and intention to vaccinate against COVID-19: Implications for public health communications. *Lancet Reg Health – Eur*. 2021;1. doi:10.1016/j.lanepe.2020.100012

14. Kricorian K, Civen R, Equils O. COVID-19 vaccine hesitancy: misinformation and perceptions of vaccine safety. *Hum Vaccines Immunother*. 2022;18(1):1950504. doi:10.1080/21645515.2021.1950504

15. Sherman SM, Smith LE, Sim J, et al. COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey. *Hum Vaccines Immunother*. 2021;17(6):1612-1621. doi:10.1080/21645515.2020.1846397

16. Dubé E, Gagnon D, Nickels E, Jeram S, Schuster M. Mapping vaccine hesitancy—Country-specific characteristics of a global phenomenon. *Vaccine*. 2014;32(49):6649-6654. doi:10.1016/j.vaccine.2014.09.039

17. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine*. 2015;33(34):4161-4164. doi:10.1016/j.vaccine.2015.04.036

18. Kutasi K, Koltai J, Szabó-Morvai Á, et al. Understanding hesitancy with revealed preferences across COVID-19 vaccine types. Published online January 4, 2022. doi:10.48550/arXiv.2111.06462

19. Dubé E, MacDonald NE. How can a global pandemic affect vaccine hesitancy? *Expert Rev Vaccines*. 2020;19(10):899-901. doi:10.1080/14760584.2020.1825944

20. Sallam M, Dababseh D, Eid H, et al. High Rates of COVID-19 Vaccine Hesitancy and Its Association with Conspiracy Beliefs: A Study in Jordan and Kuwait among Other Arab Countries. *Vaccines*. 2021;9(1):42. doi:10.3390/vaccines9010042

21. Lazarus JV, Wyka K, Rauh L, et al. Hesitant or Not? The Association of Age, Gender, and Education with Potential Acceptance of a COVID-19 Vaccine: A Country-level Analysis. *J Health Commun*. 2020;25(10):799-807. doi:10.1080/10810730.2020.1868630

22. Figueiredo A de, Simas C, Karafillakis E, Paterson P, Larson HJ. Mapping global trends in vaccine confidence and investigating barriers to vaccine uptake: a large-scale retrospective temporal modelling study. *The Lancet*. 2020;396(10255):898-908. doi:10.1016/S0140-6736(20)31558-0

23. Karafillakis E, Damme PV, Hendrickx G, Larson HJ. COVID-19 in Europe: new challenges for addressing vaccine hesitancy. *The Lancet*. 2022;399(10326):699-701. doi:10.1016/S0140-6736(22)00150-7

24. Joslyn MR, Sylvester SM. The Determinants and Consequences of Accurate Beliefs About Childhood Vaccinations. *Am Polit Res*. 2019;47(3):628-649. doi:10.1177/1532673X17745342

25. Lupton R N, Hare C. Conservatives are more likely to believe that vaccines cause autism. *Washington Post*. https://www.washingtonpost.com/news/monkey-cage/wp/2015/03/01/conservatives-are-more-likely-to-believe-that-vaccines-cause-autism/. Published 2015. Accessed March 22, 2022.

26. Baumgaertner B, Carlisle JE, Justwan F. The influence of political ideology and trust on willingness to vaccinate. *PLOS ONE*. 2018;13(1):e0191728. doi:10.1371/journal.pone.0191728

27. Jiang X, Hwang J, Su MH, Wagner MW, Shah D. Ideology and COVID-19 Vaccination Intention: Perceptual Mediators and Communication Moderators. *J Health Commun*. 2022;0(0):1-11. doi:10.1080/10810730.2022.2117438

28. Troiano G, Nardi A. Vaccine hesitancy in the era of COVID-19. *Public Health*. 2021;194:245-251. doi:10.1016/j.puhe.2021.02.025

29. Fridman A, Gershon R, Gneezy A. COVID-19 and vaccine hesitancy: A longitudinal study. *PLOS ONE*. 2021;16(4):e0250123. doi:10.1371/journal.pone.0250123

30. Goodwin R, Nguyen Luu LA, Wiwattanapantuwong J, Kovács M, Suttiwan P, Levin Y. Two-Tailed Dogs, Social Unrest and COVID-19 Vaccination: Politics, Hesitancy and Vaccine Choice in Hungary and Thailand. *Vaccines*. 2022;10(5):789. doi:10.3390/vaccines10050789

31. Statista. COVID-19 deaths per capita by country. Statista. Published 2022. Accessed September 21, 2022. https://www.statista.com/statistics/1104709/coronavirus-deaths-worldwide-per-million-inhabitants/

32. Mathieu E, Ritchie H, Ortiz-Ospina E, et al. A global database of COVID-19 vaccinations. *Nat Hum Behav*. 2021;5(7):947-953. doi:10.1038/s41562-021-01122-8

33. Information page about coronavirus. Type and quantity of vaccines that arrived in Hungary. Published January 6, 2022. Accessed September 21, 2022. https://koronavirus.gov.hu/cikkek/magyarorszagra-erkezett-vakcinak-tipusa-es-mennyisege-26

34. Bíró-Nagy A, Szászi ÁJ. The roots of COVID-19 vaccine hesitancy: evidence from Hungary. *J Behav Med*. Published online May 14, 2022. doi:10.1007/s10865-022-00314-5

35. Telex. Now then, is the opposition really anti-vaccination? telex. Published April 9, 2021. Accessed September 21, 2022. https://telex.hu/belfold/2021/04/09/fidesz-kormany-oltasellenes-ellenzek-kampany-fact-checking

36. Lindholt MF, Jørgensen F, Bor A, Petersen MB. Public acceptance of COVID-19 vaccines: cross-national evidence on levels and individual-level predictors using observational data. *BMJ Open*. 2021;11(6):e048172. doi:10.1136/bmjopen-2020-048172

37. Hainmueller J, Hopkins DJ, Yamamoto T. Causal Inference in Conjoint Analysis: Understanding Multidimensional Choices via Stated Preference Experiments. *Polit Anal*. 2014;22(1):1-30. doi:10.1093/pan/mpt024

38. Schwarzinger M, Watson V, Arwidson P, Alla F, Luchini S. COVID-19 vaccine hesitancy in a representative working-age population in France: a survey experiment based on vaccine characteristics. *Lancet Public Health*. 2021;6(4):e210-e221. doi:10.1016/S2468-2667(21)00012-8

39. Motta M. Can a COVID-19 vaccine live up to Americans' expectations? A conjoint analysis of how vaccine characteristics influence vaccination intentions. *Soc Sci Med 1982*. 2021;272:113642. doi:10.1016/j.socscimed.2020.113642

40. Barceló J, Sheen GCH, Tung HH, Wu WC. Vaccine nationalism among the public: A cross-country experimental evidence of own-country bias towards COVID-19 vaccination. *Soc Sci Med*. 2022;310:115278. doi:10.1016/j.socscimed.2022.115278

41. Stöckli S, Spälti AK, Phillips J, et al. Which vaccine attributes foster vaccine uptake? A cross-country conjoint experiment. *PLOS ONE*. 2022;17(5):e0266003. doi:10.1371/journal.pone.0266003

42. IHME. COVID-19 vaccine efficacy summary. Institute for Health Metrics and Evaluation. Published March 4, 2021. Accessed September 21, 2022. https://www.healthdata.org/covid/covid-19-vaccine-efficacy-summary

43. EMA. Comirnaty: EPAR Production Information. European Medicines Agency. Published December 21, 2020. Accessed September 21, 2022. https://www.ema.europa.eu/en/medicines/human/EPAR/comirnaty

44. Coppock A, Leeper TJ, Mullinix KJ. Generalizability of heterogeneous treatment effect estimates across samples. *Proc Natl Acad Sci U S A*. 2018;115(49):12441-12446. doi:10.1073/pnas.1808083115

45. Miratrix LW, Sekhon JS, Theodoridis AG, Campos LF. Worth Weighting? How to Think About and Use Weights in Survey Experiments. *Polit Anal*. 2018;26(3):275-291. doi:10.1017/pan.2018.1

46. ESS Round 10: European Social Survey. ESS-10 2020 Documentation Report. Edition 1.0. Published online 2022.

47. Toomey M. History, Nationalism and Democracy: Myth and Narrative in Viktor Orbán's 'Illiberal Hungary.' *New Perspect*. 2018;26(1):87-108. doi:10.1177/2336825X1802600110

Tables

Table 1 Attributes, attribute levels in the conjoint experiment, and their frequency in the data

Attributes	Attribute levels	Frequency
The vaccine was developed in…	1 = USA	788
	2 = Germany	776
	3 = China	786
	4 = Russia	767
	5 = Hungary	771
The vaccine is fully authorised in the EU	1 = Yes	1,246
	2 = No	1,264
	3 = Authorization pending	1,378
The vaccine's trial phase	1 = The vaccine has been given to a small number of persons	1,267
	2 = The vaccine has been given to several hundred persons	1,359
	3 = The vaccine has been given to several thousand persons	1,262
The vaccine's documented severe adverse events (allergic reaction, hospitalization)	1 = Not common: out of 10,000 treated patients 10-100 experience severe adverse events (0.1-1 % of all patients)	1,323
	2 = Rare: out of 10,000 treated patients 1-10 experience side effects (0.01-0.1 % of all patients)	1,254
	3 = Extremely rare: out of 10,000 treated patients less than 1 experience severe adverse events (less than 0.01 % of all patients)	1,311
The vaccine's documented mild adverse events (flu-like symptoms)	1 = Common: out of 10,000 treated persons 100-1000 experience mild adverse events (1-10 % of all patients)	969
	2 = Not common: out of 10,000 treated persons 10-100 experience mild adverse events (0.1-1 % of all patients)	1,002
	3 = Rare: out of 10,000 treated persons 1-10 experience mild adverse events (0.01-0.1 % of all patients)	999
	4 = Extremely rare: out of 10,000 treated persons less than 1 experience mild adverse events (less than 0.01 % of all patients)	918
The vaccine's efficacy (full dosage, preventing serious illness)	1 = 95 %	986
	2 = 90 %	1,005
	3 = 85 %	953
	4 = 75 %	944
How many doses are needed to reach the reported efficacy?	1 = 1	1,229
	2 = 2	1,353
	3 = 3	1,306
Cost per dosage	1 = Free	955
	2 = 1000 HU	980
	3 = 5000 HUF	990
	4 = 10000 HUF	963
Availability	1 = The vaccine is readily available	967
	2 = Patients have to wait for the vaccine for up to a week	985
	3 = Patients have to wait for the vaccine for up to a month	1,006
	4 = Patients have to wait for the vaccine for up to 3 months	930
Transmission	1 = The vaccine prevents the transmission of the virus to other people	1,970
	2 = The vaccine does not prevent the transmission of the virus to other people	1,918
Number of evaluated profiles	3,888	
Number of unique profiles	3,846	
Number of respondents	324	

Table 2 Description of the sample

			Sample distribution	Mean	Standard Deviation
Age	How old are you?			48.61	14.47
Gender	What is your gender?	Male	42.9		
		Female	57.10		
Highest education	What is your highest level of education?	No education	0.93		
		Primary	7.10		
		Vocational school	21.30		
		High-school graduation	26.23		
		Technical and further education (Hungarian: OKJ)	17.90		
		BSc/BA	17.59		
		MSc/MA	8.02		
		PhD/DLA	0.93		
Residence	Which of the following would best describe the settlement where you live?	Budapest	17.28		
		Larger city, county capital	24.69		
		Town	31.17		
		Village	26.85		
Income	Here you can see an income scale on which 1 indicates the lowest income group and 11 the highest income group in Hungary. We would like to know in what group your household is. Please, specify the appropriate number, counting all wages, salaries, pensions and other incomes that come in.	Scale: 1-11		5.18	2.09
Family status	Which of the following would best describe your family status?	Married	43.21		
		In a relationship	20.99		
		Divorced	12.35		
		Widowed	6.17		
		Single	17.28		
Religiousness	Regardless of whether you belong to a particular religion, how religious would you say you are?	Scale: 1-11		5.07	3.42
Political interest	How interested would you say you are in politics?	Scale: 1-11		6.55	3.21
Previously infected with COVID-19	Have you had a confirmed COVID-19 infection before?	Yes	34.26		
		No	65.74		
Risk of COVID-19 infection	On a scale of 1-11, how likely do you think you can be infected with COVID during the next 6 months?	Scale: 1-11		4.66	2.92
Vaccination status	Have you received at least one shot of any of the available COVID vaccines?	No	49.38		
		At least one jab	50.62		
Government voter	Supposing that there are elections held this Sunday, which party would you vote for? (Government: Fidesz – KDNP, Opposition: MSZP, Jobbik, LMP, DK, Párbeszéd, Liberálisok, Magyar Kétfarkú Kutya Párt, Momentum, Mi Hazánk, Other)	Yes	49.69		
		No	50.31		

Figure 1 AMCEs in the choice-based conjoint analysis

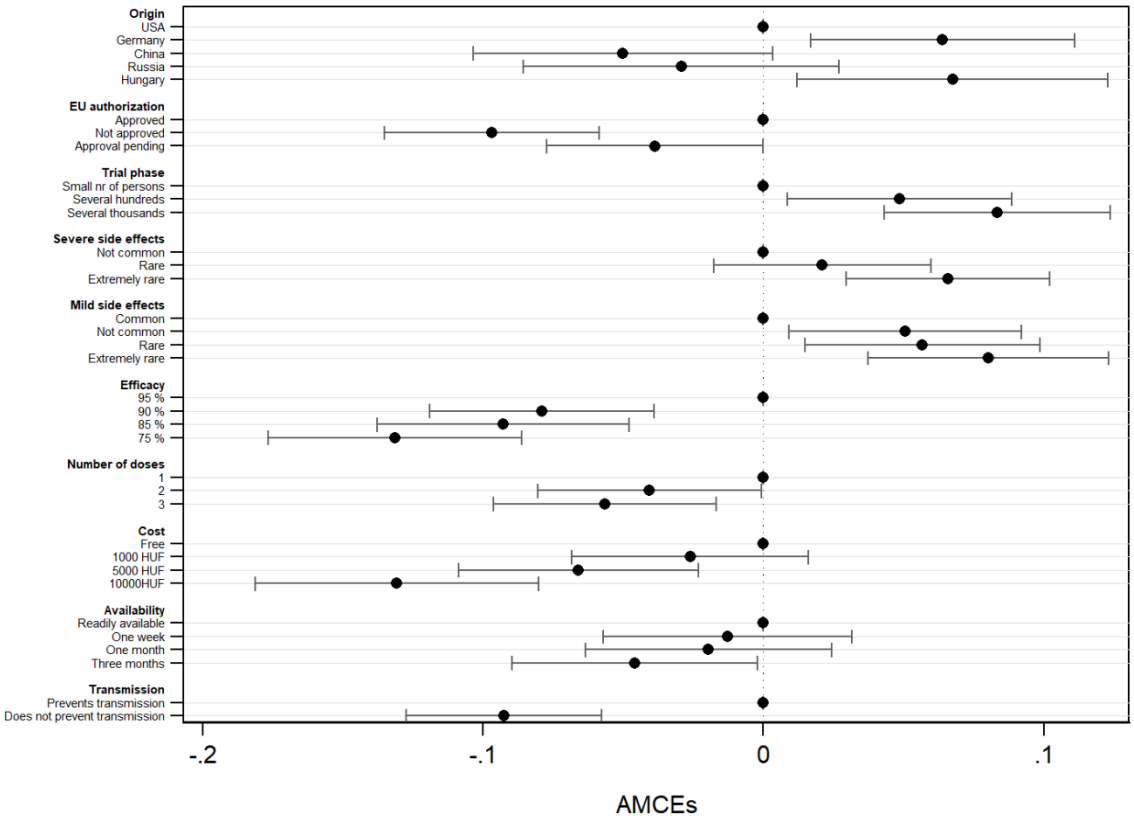

Figure 2 Marginal Means of the (a) vaccine's origin and (b) EMA approval status across party preference

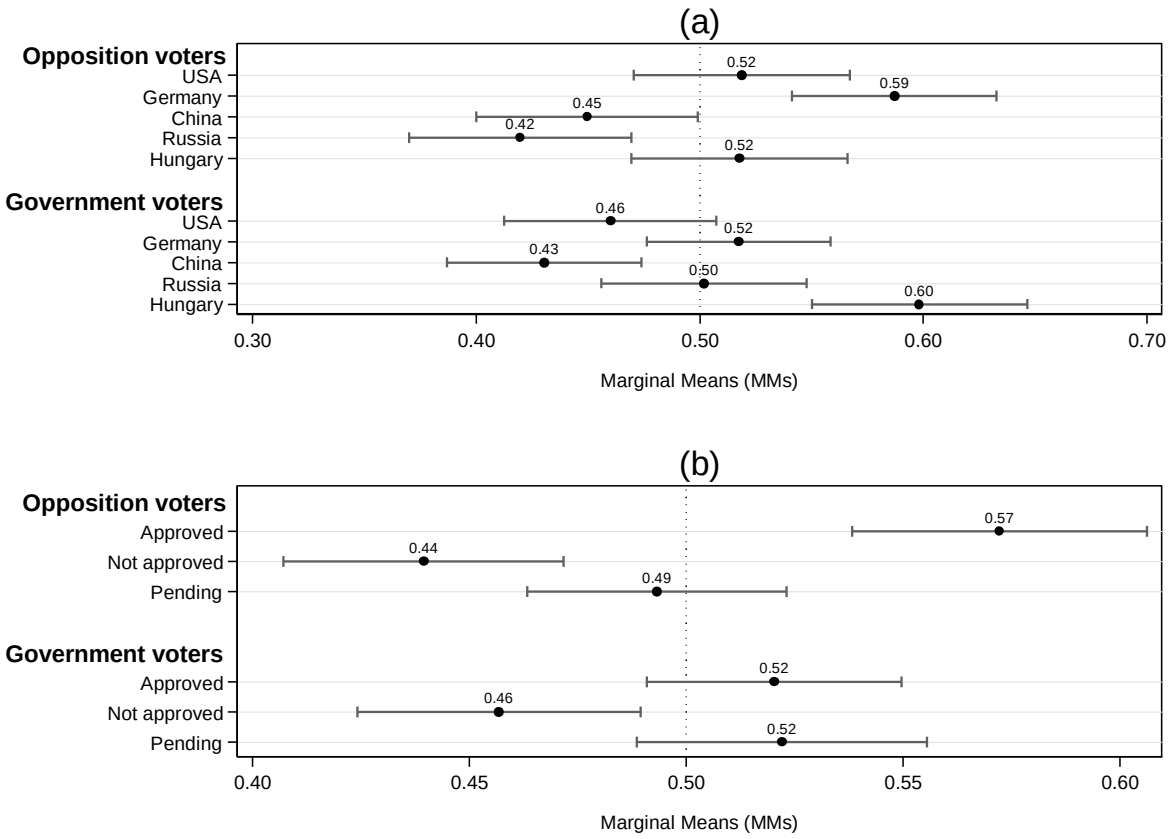

Figure 3 Marginal Means of EMA-approval across the vaccine's origin and party preference