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THE IMPACT OF MANUFACTURING ORIGIN ON COVID-19 VACCINE PERCEPTIONS: A VIGNETTE STUDY FROM TÜRKIYE

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Public perceptions and preferences regarding vaccination are crucial for shaping pandemic response strategies. Rapid COVID--19 vaccination was viewed as the only way to end the pandemic. In this study, we conducted a cross-sectional vignette study in Türkiye using five online surveys to assess participants' perceptions of vaccine efficacy based on different countries of origin. We then used standard mean comparison tests and (ordered) logistic regressions to provide evidence for the country-of--origin bias of the COVID-19 vaccines. 1615 participants answered our five surveys. Even though the two vaccines are reported to have the same efficacy, participants' subjective evaluation of the vaccine's efficacy and their willingness to get vaccinated are significantly higher when the vaccine originates from Germany rather than from China. Our findings show that the manufacturing origin of vaccines significantly influences perceptions, with people having a bias or preference towards vaccines originating from a particular source despite equal efficacy. More importantly, however, even though a vaccine has a higher efficacy, it may not be the preferred choice of individuals due to its source of origin. Public health officials should note this bias, as vaccination rates play a critical role in pandemic control.

Keywords: country-of-origin bias, COVID-19, preferences, vaccines, vignette study

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INTRODUCTION

Vaccination has been perceived as one of "medicine's greatest lifesavers" due to its impact on infections (Allen & Fitzpatrick, 2007). On March 11, 2020, following the WHO declaration of the epidemic as a pandemic, vaccination studies against the SARS-CoV2 infection were initiated in various countries. As of April 2021, there are currently about 90 vaccines against the SARS-CoV2 in Phase 1, 2, 3, and 4 clinical trials (World Health Organisation 2021a), six vaccines in early/limited use, and seven fully approved vaccines for full use (Zimmer et al., 2021).

The aim of this study is to investigate whether the country-of-origin influences people's perception of the COVID-19 vaccine's efficacy and their willingness to get vaccinated. To explore this, we designed five different vignette studies and hypothesised that individuals may hold biases – either positive or negative – towards vaccines based on their country of origin, even when the stated efficacy rates are identical. To test this hypothesis, we conducted a survey among a randomly selected group of undergraduate students from three universities, as well as members of the general public in Türkiye. Participants were asked to read hypothetical news articles (vignettes) about vaccines before completing the survey. These vignettes provided information about the efficacy rates and side effects of an anonymous vaccine, as well as vaccines originating from China and Germany. After reading the vignettes, participants were asked to evaluate the perceived efficacy of the vaccines and indicate their willingness to receive them.

Moreover, the survey also asked several demographic questions, such as the participants' education levels and their parents', age, gender, and household income. These questions were then followed by some COVID-19 related questions, such as whether they and their families have had the COVID -19 infection, whether they have had any other underlying conditions, whether they have been vaccinated against COVID-19, and whether they have ever wished to get vaccinated, as well as about their overall attitude towards a vaccine and the amount of money they would be willing to pay for another vaccine originating from a different country. Using different statistical methods, we analysed whether the country of origin of a vaccine is crucial in determining subjective efficacy and the acceptance of a vaccine.

BACKGROUND

The first COVID-19 case in Türkiye was detected on March 11, 2020. When the survey was administered between March 2020 and the end of March 2021, about 3.3 million cases in Türkiye resulted in 32,000 deaths. By June 2022, the number of total cases had risen to above 15 million and deaths close to 100,000 (WHO COVID Dashboard, 2025). Türkiye started administer-

ing the CoronaVac vaccine developed by Sinovac (China) in mid-January 2021 and Comirnaty by Pfizer/BioNTech (US/Germany) in April 2021. Later in the year, the made-in-Türkiye Turkovac vaccine was also introduced, however, it was not accepted by the public as much as the CoronoVac and Pfizer/BioNTech vaccines. By the end of March 2021, when the survey was administered, about 10.7% (close to 9 million people) of the population had at least one dose of the CoronaVac vaccine and 8.1% (about 6.8 million people) had completed the two required doses.

Before the survey, a mass vaccination campaign was initiated in January 2021 in Türkiye to vaccinate the prioritised groups consisting of healthcare workers. All pharmacy workers, social care workers, and adult residents at elderly care homes, rehabilitation centres for the disabled, and at women and children protection/foster homes, as well as all individuals aged 65 and older, and some teachers were administered the CoronaVac (Chinese origin) vaccine within the ongoing Phase 3 clinical trials (Republic of Türkiye Ministry of Health COVID-19 Vaccination Information Platform 2021).

Despite various vaccine development efforts, the WHO included vaccine hesitancy among the top-10 global health threats in 2019 (World Health Organisation, 2021b). While the effectiveness and preference rate of the SARS-CoV2 vaccine are interrelated (Kaplan & Milstein, 2021), public confidence in the SARS-CoV2 vaccine is also affected by the approval of the vaccines by political leaders (Bokemper et al., 2021). However, many possible factors affect preferences and vaccine hesitancy, such as various socio-cultural factors, including but not limited to regional differences in attitudes, religious beliefs, etc. Moreover, the country of manufacturing of the vaccine, being among the countries in which the COVID-19 cases first occurred, or the countries that are known for their cold storage, logistics, and mass vaccination units, as well as for a high prevalence of the companies that make big profits from the vaccines, may be associated with the decision to get vaccinated (Schwarzinger et al., 2010). For example, people who may perceive the vaccines in the clinical process developed in a rush may not base their decisions entirely on vaccine efficacy (Lin et al., 2021; Ward et al., 2020). In this regard, a hypothetical rapid COVID-19 vaccine development process reduced its acceptance (Hursh et al., 2020).

In a study with Americans, a vaccine originating from a non-US country (China and UK) is less likely to be preferred by individuals (Kreps et al., 2020). The same study also found that the US Centres for Disease Control and Prevention and WHO approvals are more likely to choose a vaccine when compared with President Trump's approval. In another study based on data from 19 countries, individuals were more likely to ac-

cept the vaccine because they had higher levels of trust in information received from government sources (Lazarus et al., 2021). Investigating the factors and biases that influenced individuals' vaccine preferences and addressing these before initiating a vaccination programme can improve vaccination promotion policies and vaccination decisions.

This study also builds upon multiple theoretical perspectives to understand the influence of country-of-origin bias on vaccine hesitancy. First, the Theory of Planned Behaviour (Ajzen, 1991) suggests that attitudes, subjective norms, and perceived behavioural control shape individual decisions, including vaccine acceptance. Second, the Heuristic-Systematic Model (Chen & Chaiken, 1999) explains how individuals use cognitive shortcuts – such as a vaccine's country of origin – to make decisions when faced with uncertainty; this process aligns with findings indicating that heuristic-driven shortcuts result in rapid but less stable and more biased decisions compared to systematic processing (Tversky & Kahneman, 1974).

Finally, the concept of political trust (Rudolph & Evans, 2005) plays a crucial role in public health decision-making, where trust in government, scientific institutions, and regulatory bodies affects vaccine uptake (Olsen & Tuu, 2024).

In Türkiye, COVID-19 vaccine hesitancy has been shaped by multiple factors, including historical distrust in foreign pharmaceutical companies (past negative experiences, ethical controversies, lack of transparency in clinical trials, etc.) (Soysal et al., 2021), skepticism about new medical technologies, and political polarization (Engin, & Akkoç, 2024). During the pandemic, the Turkish government initially relied on the Chinese-made CoronaVac vaccine, which faced public scrutiny due to concerns about its efficacy (Karduz & Engin, 2024; Sarimehmet et al., 2024; Soysal et al., 2021). Later, the introduction of the BioNTech/Pfizer vaccine was met with higher preference and willingness to receive the vaccine, largely favourable perceptions of its country of origin (Karduz & Engin, 2024; Sarimehmet et al., 2024), reinforcing the country-of-origin bias observed in our study. Studies on Turkish vaccine hesitancy (Salali & Uysal, 2022) suggest that trust in government, misinformation, and socio-demographic factors significantly influence vaccine uptake. Our study contributes to this body of research by examining the extent to which vaccine preferences are shaped by manufacturing origin.

Prior research has demonstrated that country-of-origin effects significantly influence consumer perceptions in various domains, including healthcare (Olsen & Tuu, 2024). In vaccine decision-making, factors such as national identity, historical trust in foreign pharmaceuticals, and government approval play a crucial role in shaping preferences (Jose, 2022). Further-

more, research on Generation Z's vaccine hesitancy highlights that younger populations are particularly influenced by social norms and digital misinformation, factors that may also interact with country-of-origin biases (Jose, 2022).

The findings of this study align with prior research indicating that vaccine hesitancy is not solely driven by concerns about efficacy but also by trust in the institutions responsible for vaccine approval (Olsen & Tuu, 2024). The role of political trust is particularly relevant in the Turkish context, where confidence in government decisions on public health has fluctuated (Engin & Akkoç, 2024). Studies have shown that individuals with lower political trust are more likely to reject vaccines, regardless of their scientific attributes (Jose, 2022). Our results also support prior work demonstrating that socio-demographic variables such as education, income, and gender significantly shape vaccine perceptions (Kose et al., 2021; Salali & Uysal, 2022; Gulle et al., 2023). Future research should explore how political polarisation and institutional credibility influence country-of-origin effects in vaccine acceptance.

METHODS

Study design and participants

We did a cross-sectional study across 1615 individuals. To this end, we designed five surveys, which were all conducted online using Google Surveys. Participants were randomly assigned to one of the five vignette-based surveys using a randomised distribution approach within each of the two main groups: university students[1] and the general public. The survey links were distributed separately to these two groups to ensure that both students and non-students were included in all survey conditions. The distribution process was designed to balance participation across the different versions of the survey as much as possible. To ensure that participants understood the hypothetical nature of the study, each survey explicitly stated at the beginning that the described vaccines were fictional and created solely for research purposes. A debriefing statement at the end of the survey reiterated that the vaccine information presented in the vignettes was hypothetical and did not correspond to real vaccines. This was done to prevent any misunderstandings regarding vaccine availability, safety, or efficacy.

The internet protocol number of participants was recorded to ensure that the same participant could not respond to two different surveys. Participants were recruited mainly from two sources: 1) Undergraduate students at three large public universities which the authors are affiliated with and 2) General public. Survey requests were sent to the student partic-

ipants, student email groups, and the general public through social media. People younger than 18 years of age or unwilling or unable to consent to the study were excluded from participation. In total, we ended up with 1615 responses to all of our five surveys. 876 of these responses are from university students and 739 from the general public. This study was approved by the Social Science Research Ethics Review Board (2021-11) of Bogazici University and the Ministry of Health. All participants were provided written informed consent. We should also note that, although our study employed convenience sampling, we did not apply post-stratification adjustments. This remains a limitation, as certain demographic groups may be over- or under-represented in our sample, potentially influencing the generalisability of our findings.

Surveys were conducted online in late March 2021. The questionnaire covered a vignette giving some hypothetical news about the efficacy of different COVID-19 vaccines, followed by questions directly related to the vignette and some demographic and COVID-19 related questions. The questionnaire was pre-tested during a pilot phase. Responses were recorded via Google Surveys. Here, our primary variables are 1) the subjective reflection about the efficacy of the vaccine measured in an ordered scale from 1 to 5 based on the question "How effective does this vaccine seem to you?", and then 2) a measure about the acceptance of the vaccine constructed again in an ordered scale from 1 to 5 after the following question: "Would you get this vaccine?" Notice that here, we differentiate between subjective efficacy (how efficient does this vaccine seem to you) and acceptance (Would you get this vaccine?) with two separate questions. We repeat this latter question after mentioning a hypothetical endorsement by the WHO and after increasing or reducing its reported efficacy, to 95% and 75%, from the initially mentioned benchmark rate of 85%. Survey 1 conducts the survey with a vaccine that is said to be originating from China; Survey 2 applies the same survey with a vaccine originating specifically from Germany, and Survey 3 does not mention the source country. Finally, Surveys 4 and 5 both include information about two vaccines in the same survey. The vaccine from China has an 85% efficacy in Survey 4, and the German vaccine has 80%. In Survey 5, these rates are 85% and 75%, respectively, i.e. we increase the reported differences in the efficacy rates.

Statistical analysis

We calculate the means and standard deviations of several key variables related to the subjective efficacy of the vaccine and its acceptance (based on answers to the "How effective does this vaccine seem to you?" and "Would you get this vaccine?"

questions) in different surveys and compare these means against each other using standard mean comparison *t*-tests and the Kruskal-Wallis tests. Moreover, we also run several regressions to identify the existence of potential bias towards the vaccine. We combine all the survey responses from the first three surveys and then regress the subjective efficacy and acceptance, both ordered variables, to several variables, including dummy variables for each of the three surveys. As it is well known, ordered logistic regressions are the norm when the dependent variable, like the ones we use in our surveys to measure subjective efficacy or acceptance (both on a scale from 1-to-5), is ordered. Using the standard ordinary least squares regression is not appropriate for this data. Several of its assumptions are not satisfied when using it with a non-interval outcome variable. Moreover, to see the predictors of the bias, we also run several logistic regressions of a binary dummy variable that serves as a proxy for the bias for efficacy and acceptance.

RESULTS

Table 1 illustrates the means and standard deviations of the five variables (subjective efficacy and acceptance to take the vaccine with the given information, i.e., 85% reported efficacy, additionally with WHO endorsement, and finally when the reported efficacy reduces to 75% and increases to 95%) in the first three surveys. The table also presents the *p*-value associated with the Kruskal-Wallis test for the equality of the means of variables in three surveys. The test results suggest a significant difference when all means are compared against each other.

TABLE 1
Subjective efficacy and acceptance in Surveys 1 to 3

	Survey-1 (Chinese 85%) 314 responses	Survey-2 (German 85%) 398 responses	Survey-3 (Anonymous 85%) 315 responses	Kruskal--Wallis test
Subjective efficacy	3.15±0.98	3.41±0.88	3.21±0.95	0.0002
Taking the vaccine (Acceptance)	3.14±1.33	3.43±1.34	3.17±1.30	0.0038
Taking the vaccine after WHO endorsement	3.22±1.35	3.56±1.27	3.39±1.31	0.0044
Taking the vaccine if reported efficacy is 95%	3.91±1.24	4.14±1.14	3.96±1.20	0.0145
Taking the vaccine if reported efficacy is 75%	2.67±1.35	3.02±1.37	2.75±1.26	0.0014

When the means of all the five variables in Survey 1 mentioning that the reportedly 85% efficacious vaccine originated from China and Survey 2, where the vaccine is said to be originated from Germany are compared against each other using

mean comparison t-tests, we observe that the efficacy (p-value = 0.0002), taking the vaccine (p-value = 0.0041), after WHO endorsement (p-value = 0.0006), with 95% reported efficacy (p-value = 0.0103) and with 75% reported efficacy (p-value = 0.0007) are all significantly different from each other, where all the averages in Survey 2 (where reportedly the vaccine is from Germany) are higher than the ones in the Survey 1 (where reportedly the vaccine is from China).

In Table 2 we present the means and standard deviations of some key variables from Surveys 4 and 5.

TABLE 2
Relative efficacy and acceptance in Surveys 4 and 5

	Survey-4 287 responses	Survey-5 301 responses
Subjective efficacy of the German vaccine	3.22±0.86	3.07±0.94
Taking the German vaccine (Acceptance)	3.28±1.32	3.18±1.38
Subjective efficacy of the Chinese vaccine	3.32±0.95	3.44±1.06
Taking the Chinese vaccine (Acceptance)	3.22±1.32	3.31±1.40

Here, the vignette includes vignette information about two vaccines. In Survey 4, the vaccine originating from China has 85% reported efficacy whereas the one from Germany has 80% reported efficacy. In Survey 5, the reported efficacy of the German vaccine is reduced to 75%. In Survey 4, the subjective efficacy (in the views of the participants) of the German vaccine is at 3.22 (±0.86) and the Chinese vaccine is at 3.32 (±0.95), and there is no significant difference between these two means (p-value = 0.1867). When asked about the likelihood of getting either vaccine, the average for the German vaccine, 3.28 (±1.32), is not significantly different from the Chinese vaccine, 3.22±1.32 (p-value = 0.5863). However, in Survey 5, when the efficacy differences in the vignette are further increased at the expense of the German vaccine, the subjective efficacy of the German vaccine drops to 3.07±0.94, whereas the one of the Chinese vaccine increases to 3.44±1.06, and their difference becomes significant (p-value < 0.0001). However, still, when asked whether they would take the vaccine, there is still no significant difference between the German (3.18±1.38) and the Chinese (3.31±1.40) vaccines (p-value = 0.2517). In fact in Survey 4, 35 respondents out of 301 in total respond that the efficacy of the Chinese vaccine is strictly less than the one of the German vaccine and 81 indicate that they will strictly prefer to get the German vaccine over the Chinese one. When the reported efficacy differences are increased to 10% in Survey 5, these numbers drop down to 19 and 29, respectively, but are still substantial.

Before proceeding with the ordered logistic regression results, Table 3 presents some descriptive summary statistics of various variables used in the analysis across all surveys.

TABLE 3
Summary statistics

	Survey-1	Survey-2	Survey-3	Survey-4	Survey-5
Age (years)	30.30±12.12	28.19±16.70	26.26±9.27	28.51±11.49	24.19±6.77
Female (%)	46.82	53.27	51.11	63.07	49.17
Mother's education (%)					
1 Incomplete elementary	13.06	11.31	12.70	13.24	9.63
2 Elementary	50.32	34.17	41.90	45.99	33.55
3 Secondary	21.97	25.38	21.59	23.69	26.91
4 Higher	12.74	24.87	20	15.33	25.91
5 Graduate	1.91	4.27	3.81	1.74	3.99
Monthly household income (%)					
1 Less than 3000 TRY	18.15	7.79	15.24	17.07	14.95
2 Between 3000 and 6000 TRY	27.71	31.16	28.25	32.06	30.56
3 Between 6000 and 9000 TRY	20.38	17.34	27.94	21.95	22.59
4 Above 9000 TRY	33.76	43.72	28.57	28.92	31.89
Already had COVID-19 vaccine (%)					
Yes	4.78	2.51	5.40	3.83	1.99
Will you get the vaccine? (%)					
Yes	53.50	61.06	54.92	55.75	58.80
No	19.43	17.09	14.92	17.07	17.28
Unknown	27.07	21.86	30.16	27.18	24.25
Presence of underlying conditions (%)					
Yes	12.10	7.79	7.30	6.27	5.98
No	83.12	88.69	89.21	89.20	88.70
Unknown	4.78	3.52	3.49	4.53	5.32
Did you get the COVID-19 disease? (%)					
Yes	11.46	12.31	10.48	7.67	10.63
No	82.17	79.90	80.00	86.06	81.06
Unknown	6.37	7.79	9.52	6.27	8.31
Had COVID-19 vaccine, someone in the family (%)					
Yes	44.90	56.53	41.90	47.39	39.20
No	54.14	43.47	57.14	52.26	58.47
Unknown	0.96	0.00	0.95	0.35	2.33
COVID-19 death, someone in the family (%)					
Yes	8.28	6.03	6.67	8.01	6.31
No	91.40	93.72	92.30	90.59	93.02
Unknown	0.32	0.25	0.95	1.39	0.66
Ready to pay for a vaccine (%)					
Yes	68.15	71.36	62.54	58.19	64.45
General attitude towards the vaccine (%)					
1 Against any vaccine	3.18	3.52	6.67	3.83	5.65
2 Not against all vaccine but unsure about COVID-19	64.97	54.02	66.03	65.16	59.14
3 In favour of any vaccine	31.85	42.46	27.30	31.01	35.22

In addition to the dummy variables for different surveys, based on our careful reading of the literature, we include age, a dummy variable for females, a categorical variable for the education of the mother (of the survey respondent), a categorical variable for the household income, dummies for already having the COVID-19 vaccine, intention to get the vaccine, presence of underlying conditions, having got the COVID-19 disease, having someone get the vaccine in the immediate family as well as presence of a death in the immediate family due to COVID-19, being willing to pay for the COVID-19 vaccine and a categorical variable to measure general attitude towards vaccinations. In our survey, 7.67% to 12.31% of respondents had COVID-19, and 1.99% to 5.40% had at least one dose of the COVID-19 vaccine at the time of the survey. Hypothesising that there is a country-of-origin bias in favour of the German and against the Chinese vaccine, we do expect a positive sign for the dummy of the German vaccine both for the regressions of efficacy and acceptance. Moreover, for the regressions of acceptance, but not necessarily of efficacy, a priori we also expect a positive sign for the dummies of having someone get the COVID-19 vaccine in the family, an underlying condition, a covid-related fatality in the family, and a positive attitude towards overall vaccinations.

Table 4 presents regressions of the subjective efficacy and acceptance on a number of variables.

In the first three regressions the dependent variable is the subjective efficacy, whereas in the last three regressions it is the acceptance variable. All regressions are ordered logistic regressions because both dependent variables are ordered on a scale from 1 to 5.

Here, the results presented in the first row are of particular interest. The significantly positive estimated coefficient of the dummy associated with the second survey (with a vaccine originating from Germany) indicates that, after controlling for several different factors that might be associated with the subjective efficacy or acceptance, the respondents report that the efficacy of the German vaccine is higher and are also more likely to accept the German vaccine compared to the Chinese vaccine. Particularly, when the marginal effects are calculated, after controlling for various related predictors we observe that the likelihood of choosing the choice 4 or 5 for the vaccine efficacy and acceptance is 4 to 5% higher for the German vaccine compared to the Chinese one. On the other hand, we do not observe a significant difference between the Chinese and anonymous vaccines. Other variables that are significantly associated with the subjective efficacy of the vaccines are gender, willingness to get the vaccine, willingness to pay for the vaccine, and general attitude towards vaccination.

TABLE 4
Regressions of subjective efficacy and acceptance in Surveys 1 to 3

Variables	Subj. efficacy	Subj. efficacy	Efficacy	Acceptance	Acceptance	Acceptance
German vaccine (Survey-2)	0.39*** (0.16)	0.42*** (0.16)	0.42*** (0.16)	0.30** (0.15)	0.37** (0.16)	0.38** (0.16)
Anon. vaccine (Survey-3)	-0.02 (0.17)	-0.02 (0.17)	0.15 (0.18)	-0.02 (0.15)	0.28 (0.16)	0.30 (0.16)
Age	-0.002 (0.004)	-0.002 (0.004)	-0.003 (0.005)	0.004 (0.003)	0.003 (0.003)	0.003 (0.003)
Female	-0.52*** (0.13)	-0.44*** (0.13)	-0.43*** (0.13)	-0.20 (0.12)	-0.09 (0.12)	-0.11 (0.12)
Had COVID-19 vaccine	0.73 (0.41)	0.65 (0.45)	0.68 (0.44)	1.44*** (0.44)	1.37*** (0.50)	1.43*** (0.50)
Will have COVID-19 vaccine	1.86*** (0.14)	1.25*** (0.15)	1.26*** (0.16)	3.32*** (0.17)	2.62*** (0.18)	2.64*** (0.18)
COVID-19 vaccine in family		-0.10 (0.13)	-0.11 (0.13)		0.10 (0.12)	0.07 (0.13)
Underlying conditions		-0.33 (0.23)	-0.33 (0.23)		-0.29 (0.22)	-0.27 (0.23)
Got COVID-19		-0.23 (0.20)	-0.24 (0.20)		-0.23 (0.18)	-0.24 (0.18)
Fatality in family		-0.02 (0.25)	-0.02 (0.26)		0.16 (0.24)	0.14 (0.24)
Will pay for the vaccine		0.51*** (0.15)	0.50*** (0.15)		0.76*** (0.14)	0.73*** (0.14)
General attitude-2			0.36 (0.37)		0.76** (0.39)	0.73 (0.39)
General attitude-3			1.47*** (0.40)		2.26*** (0.42)	2.25*** (0.43)
Income-2			-0.08 (0.19)			-0.03 (0.19)
Income-3			0.05 (0.21)			0.16 (0.21)
Income-4			0.02 (0.22)			0.18 (0.22)
Mother's education-2			-0.17 (0.21)			0.31 (0.20)
Mother's education-3			0.03 (0.23)			0.55*** (0.22)
Mother's education-4			-0.16 (0.25)			0.50** (0.23)
Mother's education-5			-0.31 (0.42)			-0.66 (0.37)
Observations	1026	1026	1026	1026	1026	1026
Pseudo *R*-squared	0.11	0.14	0.14	0.20	0.24	0.25
Wald chi-test (*p*-value)	0.00	0.00	0.00	0.00	0.00	0.00

Robust standard errors in parentheses. Regressions include dummies for the colleges of the respondents. *** $p < 0.01$, ** $p < 0.05$

Mainly, Table 4 indicates that the subjective efficacy is lower for females and higher for those who indicate that they will get a vaccine, those who are ready to pay for a vaccine, and those in favour of any vaccination. As for the acceptance of the vaccine described in the vignette, significant factors are already having a vaccine, willingness to get the vaccine, willingness to pay for the vaccine, general attitude towards vaccinations, and the education of the respondent's mother. Specifically, those who already had a vaccine and those who are willing to get one or pay and favour any vaccine indicate a higher level of acceptance. Moreover, those whose mothers have secondary or higher education (relative to elementary education) show a higher level of acceptance of getting the vaccine.

Next, in Table 5 we use the same combined dataset (so all observations from all three surveys) from three surveys and only run the sixth regression of Table 4 with the same set of predictors and using data from the first three surveys.

TABLE 5
Regressions of acceptance under different scenarios

(Criterion: Acceptance) Variables	75% reported efficacy		95% reported efficacy		After reported WHO endorsement	
German vaccine	0.35**	(0.16)	0.43***	(0.17)	0.34**	(0.17)
Anonymous vaccine	0.35**	(0.17)	0.39**	(0.18)	0.31	(0.17)
Age	0.001	(0.003)	-0.0004	(0.003)	-0.001	(0.005)
Female	0.07	(0.12)	-0.05	(0.13)	-0.001	(0.12)
Had COVID-19 vaccine	1.31***	(0.38)	1.50***	(0.58)	1.25***	(0.39)
Will have COVID-19 vaccine	1.36***	(0.15)	1.59***	(0.17)	1.52***	(0.15)
COVID-19 vaccine in family	0.23	(0.12)	0.13	(0.13)	0.16	(0.12)
Underlying conditions	-0.09	(0.24)	0.01	(0.25)	-0.44**	(0.22)
Got COVID-19	-0.17	(0.18)	-0.14	(0.21)	0.13	(0.17)
Fatality in family	0.67***	(0.20)	0.08	(0.26)	0.01	(0.22)
Will pay for the vaccine	0.72***	(0.14)	0.85***	(0.15)	0.64***	(0.14)
General attitude-2	1.00***	(0.38)	1.12***	(0.30)	0.88***	(0.31)
General attitude-3	2.40***	(0.41)	1.98***	(0.36)	1.77***	(0.35)
Income-2	0.11	(0.19)	0.22	(0.21)	-0.01	(0.19)
Income-3	0.18	(0.21)	0.18	(0.23)	0.33	(0.21)
Income-4	0.33	(0.21)	0.05	(0.24)	0.11	(0.22)
Mother's education-2	-0.07	(0.20)	0.31	(0.21)	0.27	(0.22)
Mother's education-3	0.13	(0.22)	0.08	(0.22)	0.15	(0.23)
Mother's education-4	0.04	(0.23)	0.32	(0.26)	0.35	(0.25)
Mother's education-5	-0.54	(0.44)	-0.42	(0.36)	-0.43	(0.34)
Observations	1026		1026		1026	
Pseudo *R*-squared	0.17		0.16		0.14	
Wald chi-test (*p*-value)	0.00		0.00		0.00	

Robust standard errors in parentheses. Regressions include dummies for the colleges of the respondents. *** $p < 0.01$, ** $p < 0.05$

However, this time the dependent variables are acceptance towards the vaccine when the vaccine in the vignette has 75% or 95% of efficacy or is endorsed by a hypothetical representative of the WHO. The results are essentially highly like the ones reported in Table 4. Notably, independent of whether the reported vaccine efficacy drops down to 75% or increases to 95% or is endorsed by a representative of the WHO, the estimated coefficient of the German vaccine (i.e. the dummy variable associated with using the data from the survey where reportedly the vaccine is originating from Germany) is significantly positive. Additionally, already having the vaccine, willingness to have the vaccine, willingness to pay for the vaccine, and general attitude towards vaccines again are significantly associated with acceptance.

Finally, Table 6, using data from Survey 4 and Survey 5, respectively, presents logistic regressions of two variables that aim to measure the bias towards the country of origin of vaccines.

These two variables are constructed in the following way: The first dependent variable, efficacy bias, takes the value of 1 if the subjective efficacy of the Chinese vaccine is strictly smaller than the one of the German vaccines. The second one, acceptance bias, is constructed when the acceptance of the Chinese vaccine is strictly smaller than the one[2] of the German vaccine.

Since in both surveys the efficacy of the Chinese vaccine, as reported in the vignette, is strictly larger (the difference is 5% for Survey 4 and 10% for Survey 5) than the efficacy of the German vaccine, these variables are used to proxy the level of the bias.

In Table 6, we have the results of four such logistic regressions. In the first one of the efficacy biases, we observe that those who mention that they will get a COVID-19 vaccine and those whose mothers have completed at least higher education have a lower probability to have a bias. On the other hand, those who are ready to pay for the vaccine are associated with a larger probability of having an efficacy bias. As for the acceptance of getting the vaccine, predictors that are associated with a bias are gender and income. Accordingly, females and those in the third income category have a lower bias towards the acceptance of the vaccine.

Next, when we increase the efficacy differences between the two vaccines to 10% in Survey 5, the regressions reported in the last two columns suggest that none of the predictors we have included in our survey are significantly associated with any of the bias types.

Variables	Survey 4 Efficacy bias	Survey 4 Acceptance bias	Survey 5 Efficacy bias	Survey 5 Acceptance bias
Age	-0.003	-0.003	0.003	-0.004
	(0.002)	(0.003)	(0.004)	(0.004)
Female	-0.03	-0.09**	0.01	0.01
	(0.04)	(0.04)	(0.03)	(0.03)
Had COVID-19 vaccine	0.11	0.13	NA	0.07
	(0.08)	(0.10)	NA	(0.12)
Will have COVID-19 vaccine	-0.09**	-0.05	0.02	-0.008
	(0.04)	(0.05)	(0.04)	(0.04)
COVID-19 vaccine in family	0.008	0.02	0.02	-0.01
	(0.05)	(0.05)	(0.03)	(0.03)
Got COVID-19	-0.02	0.08	-0.03	0.04
	(0.07)	(0.07)	(0.06)	(0.05)
Fatality in family	-0.02	-0.02	-0.007	-0.009
	(0.08)	(0.08)	(0.05)	(0.06)
Will pay for the vaccine	0.10**	0.07	-0.04	-0.007
	(0.05)	(0.05)	(0.04)	(0.05)
Income-2	-0.006	0.005	-0.02	-0.04
	(0.05)	(0.07)	(0.06)	(0.05)
Income-3	-0.03	-0.13**	-0.05	-0.05
	(0.06)	(0.07)	(0.07)	(0.07)
Income-4	0.01	-0.05	-0.11	-0.001
	(0.07)	(0.08)	(0.06)	(0.09)
Mother's education-2	-0.07	-0.01	0.02	0.009
	(0.09)	(0.07)	(0.04)	(0.06)
Mother's education-3	-0.12	-0.03	0.005	-0.02
	(0.09)	(0.08)	(0.04)	(0.07)
Mother's education-4	-0.18**	-0.07	0.04	-0.04
	(0.08)	(0.08)	(0.06)	(0.07)
Mother's education-5	-0.07	-0.07	NA	-0.02
	(0.13)	(0.12)	NA	(0.09)
Observations	287	287	283	301
Pseudo *R*-squared	0.08	0.07	0.12	0.04
Wald chi-test (*p*-value)	0.55	0.46	0.40	0.86

TABLE 6
Regressions of efficacy and acceptance biases in Surveys 4 and 5

The presented values are average marginal effects on the bias. Robust standard errors in parentheses. Regressions include dummies for colleges of the respondents.
*** $p < 0.01$, ** $p < 0.05$

DISCUSSION AND CONCLUSION

To the best of our knowledge, this study is the first to evaluate the subjective evaluation of the efficacy and acceptance of the COVID-19 vaccines. Our results show that the manufacturing origin of the vaccine plays a significant role in people's perceptions about the vaccine. Specifically, even though the objective efficacy of the vaccine is the same, people may have

a bias/preference towards a vaccine originating from a particular source. More importantly, even though a vaccine has a lower efficacy, it may not be the preferred choice of individuals due to its source of origin. This is an essential result that public health officials and scientists should consider, mainly because the vaccination rates throughout the pandemic will play a key role in controlling the pandemic. As a policy recommendation, we believe that particular emphasis should be given to the transparency about vaccinations, vaccine ingredients, and vaccine efficacy rates to convince the public about the true impact and importance of vaccinations, not only for the COVID-19 vaccines but vaccines in general.

Our results are also related to the country-of-origin literature in economics and management/marketing sciences. The main finding in that literature, as summarised by thorough reviews and meta-analyses (Verlegh & Steenkamp, 1999; Wilcox, 2015), the country of origin plays a crucial role in the perceived quality and attributes of a product. On the other hand, the effect on purchase intentions is less than on perceived quality. In our study, as illustrated by the results presented in Table 4, country of origin plays a role in both the perceived quality (subjective efficacy) and vaccination intentions (acceptance). However, the marginal effects are somewhat lower for the acceptance.

In another related paper (Mirzaee et al., 2021), the authors provide evidence from Iranian social media users that the country of origin matters in people's choices on COVID-19 vaccines. Specifically, they show that German vaccines are the most trusted by the participants of their survey conducted in Iran, followed by the US and then Russia and China.

These findings align with the broader literature on country-of-origin effects in consumer behaviour and risk perception (Verlegh & Steenkamp, 1999; Wilcox, 2015). In economics and marketing research, country-of-origin biases have been extensively documented in shaping consumer preferences for products ranging from automobiles to pharmaceuticals (Olsen et al., 2024). A systematic review of 48 countries revealed that vaccine perceptions are significantly influenced by the country-of-origin effect, with higher acceptance rates for Western vaccines, such as BioNTech/Pfizer, observed in Türkiye, Europe, Latin America, and Asia, while significant distrust towards Chinese and Russian vaccines is shaped by national biases and demographic factors, such as age and education (Frade et al., 2025). Our study extends this research into the public health domain, showing that similar biases influence vaccine acceptance – a decision with critical implications for global health policy. Unlike conventional consumer choices, vaccine hesitancy can have societal consequences, such as lower immunisation rates and prolonged pandemics. Understanding

how country-of-origin effects interact with vaccine trust can help policymakers develop more effective public health communication strategies.

Additionally, our findings resonate with research in behavioural economics and psychology that examines how trust and perceived competence influence health decisions (Hornsey et al., 2018; Jose, 2022). In particular, the Heuristic-Systematic Model (Chen & Chaiken, 1999) provides a useful framework for understanding our results. Consumers evaluate the products of developed countries more positively than those of developing countries and are biased that their products are of higher quality (Thøgersen et al., 2019). It is known that country of origin bias significantly affects consumer's brand perception, luxury product purchasing behaviour, and remembering the benefits provided to them in the past by a product known to be produced with high production standards (Chryssochoidis et al., 2007; Godey et al., 2012, Herz, 2015; Ozretic-Dosen et al., 2007; Panda & Misra, 2014; Van Der Lans et al., 2001; Van Ittersum et al., 2003). The study on country-of--origin bias regarding German and Chinese products found that people evaluated German products more positively than Chinese products regarding quality, performance, appearance, and attractiveness. This heuristic causes people to make decisions with a country-of-origin bias (Holtbrügge & Zeier, 2017; Payne & Crowley, 2008; Rodrigues et al., 2020).

Participants in our study appear to rely on heuristics (e.g., "vaccines from developed countries are better") rather than systematically evaluating the information provided in the vignette. This type of cognitive shortcut is commonly observed in situations of high uncertainty and risk, where individuals use simplified decision rules rather than engaging in thorough information processing.

The role of political trust also emerges as a key factor. Prior research (Salali & Uysal, 2021; Olsen et al., 2024; Uzelac et al., 2021) suggests that vaccine hesitancy is often linked to distrust in government institutions and health authorities. In the Turkish context, public skepticism regarding the initial rollout of Chinese vaccines likely contributed to the biases observed in our study. Political narratives surrounding vaccine approval, combined with historical distrust in certain pharmaceutical providers, may have reinforced these biases, leading participants to express greater acceptance of the German vaccine. Future research could examine how trust in domestic vs international health organisations affects vaccine preferences and whether endorsements from trusted institutions (e.g., WHO, FDA, or national regulatory bodies) can mitigate country-of-origin effects.

From a policy perspective, our findings suggest that public health officials should emphasise transparent and evidence-based vaccine communication to counteract misperceptions driven by country stereotypes. For instance, public health campaigns should highlight scientific consensus on vaccine safety and efficacy, regardless of origin, and counteract misinformation that frames vaccines as inferior based on their country of manufacture. Additionally, governments and health organisations should work to strengthen international cooperation and standardisation in vaccine development to ensure that trust is based on scientific evidence rather than geopolitical associations.

We should also yield that our results might have several limitations. First, even though we made every effort to have samples representative of the overall population, the weight of the college students in our sample is higher than the overall population. Moreover, the colleges where the surveys were conducted were not randomly selected but were mainly a convenience as they are the institutions the authors are affiliated with. Information bias could have also affected results since answers to all questions were self-reported. Our efforts to mitigate information bias included pre-tested questionnaires (in the form of conducting small-scale pilot surveys) and training of the study team (in the form of giving appropriate information about the survey when sharing the links with the subjects). Third, there was an intense debate on the efficacy of "Chinese" and "German" vaccines in early 2021 in Türkiye, and the public preferred the "German" vaccine because of its higher efficacy. Another study on hypothetical vaccine efficacy preferences in Chinese adults was conducted. This study relied on domestic vaccines (Yu et al., 2024). We did not include a vaccine sample produced in Türkiye in our survey because nationalist bias might occur (Krumer et al., 2022; Lyngstad et al., 2020).

Fifth, we could have employed mixed methods, where we could carry out some structured interviews with some selected participants on a pre-defined criterion. This could ultimately yield some evidence about the reasoning of the findings. However, we leave this to a future study.

NOTES

[1] One potential limitation of our study is the difference in vaccine perceptions between university students and the general population. Younger, more educated individuals (such as university students) may have different attitudes towards vaccines compared to older individuals or those with lower levels of formal education. Research suggests that students may be more exposed to scientific information and less susceptible to misinformation, which could influence their willingness to accept vaccines. This demographic bias should be considered when interpreting the findings.

[2] When we defined the efficacy and acceptance biases as the difference or the ratio between the acceptance and subjective efficacy of two vaccines, we obtained qualitatively similar results using these two alternative definitions. These additional results are available upon request.

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KAMILÇELEBI, H.,
ELGIN, C.: THE IMPACT...

Utjecaj podrijetla proizvodnje na percepcije cjepiva protiv bolesti COVID-19: studija vinjeta iz Turske

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Percepcija i preferencije javnosti u vezi s cijepljenjem ključne su za oblikovanje strategija odgovora na pandemiju. Brzo cijepljenje protiv bolesti COVID-19 smatralo se jedinim načinom za okončanje pandemije. U ovoj studiji proveli smo presječnu studiju vinjeta u Turskoj, rabeći pet online anketa kako bismo procijenili percepcije sudionika o učinkovitosti cjepiva na temelju podrijetla proizvodnje iz raznih zemalja. Zatim smo upotrijebili standardne testove usporedbe srednjih vrijednosti i (uređene) logističke regresije, kako bismo pružili dokaze o pristranosti prema cjepivu protiv bolesti COVID-19 s obzirom na zemlju proizvodnje. Na naših pet anketa odgovorilo je 1615 sudionika. Iako se navodi da dva cjepiva imaju istu učinkovitost, subjektivna procjena sudionika o učinkovitosti cjepiva i njihova spremnost na cijepljenje značajno su veće kada cjepivo potječe iz Njemačke umjesto iz Kine. Naši nalazi pokazuju da podrijetlo proizvodnje cjepiva značajno utječe na percepciju, pri čemu su ljudi pristrani ili preferiraju cjepiva koja potječu iz određenoga izvora unatoč jednakoj učinkovitosti. Što je još važnije, iako cjepivo ima veću učinkovitost, možda nije preferirani izbor pojedinaca zbog svoga podrijetla. Službenici javnoga zdravstva trebaju razmotriti ovu pristranost, jer stope cijepljenja imaju ključnu ulogu u kontroli pandemija.

Ključne riječi: pristranost prema zemlji podrijetla, COVID-19, preferencije, cjepiva, studija vinjeta