Seminar

Social Norms and Social Transformation

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Vaccination Attitude: Peer Effect and Anchoring Effect

Abstract:

With developments in medicine, world community has come to agreement that vaccines are the most efficient way of fighting against the viruses. However, various myths, lack of transparency and general fear of the long-term consequences of the vaccines create certain perceptions. While there are several channels of influences on those perceptions, this research is dedicated to studying relationship between peer effect, anchoring effect, and general vaccination attitudes. The experiment was done with help of surveys among students of Philipps-University Marburg. We obtain some significant results that are in line with the literature and previous studies. Social norms have effects on perception of vaccinations and can be used as a tool to shape general attitudes about vaccines and contribute to handling disease outbreaks.

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1. Introduction

The beginning of the new decade of the 21st century is marked with humanitarian disasters, significant losses of human lives and the global fight against pandemic. From policies on self-distancing to research and development of the cure from SARS-Cov-2 virus, people all over the world have been trying to have positive input in ending the pandemic. In the third quarter of 2020 already (Tung Le et al., 2020), there were over 30 samples of vaccinations in the laboratories to be tested for being fit for distribution to the public. However, despite the difficulties brought to many infrastructures and businesses and disruptions in normality of regular lives, introduction of vaccinations against COVID-19 has not been immediately accepted.

The hesitancy of being vaccinated has several channels of influence: some people do not trust the effectiveness or safety of the vaccinations; others bring arguments about personal freedom and autonomy. Additionally, not everyone has had immediate access to the vaccinations and there are many myths surrounding the process of obtaining vaccines. These conspiracy theories, lack of properly delivered real information on vaccinations indicate that people can be influenced to believe in non-factual things. Lack of trust to vaccinations has been gaining trend among parents and many adolescents are being withhold from being vaccinated (Leight, Safran, 2019). These facts raised the question that motivated the experiment, analyzed in this research – Is there influence of peer effect on the vaccination attitudes? Humankind is, at its core, a social creature– it is necessary to experience feelings of inclusion and acceptance in the community. With the COVID-19 outbreak, the division of the opinions about vaccinations has been significantly obvious and people would likely support ideas that are accepted by their peers as well. According to a study done in 1936 (Sherif), when uncertainty and instability arise, people conclude that “the group must be right”. And because for a social norm to be established, it needs to be communicated and spread (Cialdini, Trost, 1998), vaccination attitudes have been showing signs of being influenced by the peer effect. The main goal of this experiment is to find evidence of influence of vaccination attitudes by peer effect. Hesitancy of getting vaccinated can have significantly negative effects on the epidemiological situation. By finding which components of “peer” group affects the attitude the most, people could be nudged more specifically and in personalized way to getting vaccinated, which could decrease the spread of the disease.

2. Literature Review

The studies on social norms and peer effects have been extensive and have taken place for almost a century. These studies have found that when majority of other kids are vaccinated against certain disease, parents are more accepting of the vaccination for their children (Sturm et al., 2005). Similar results were found in the study by Brunson (2013) – parents who did not communicate with other parents of their children's friends, thought that majority are against vaccination. Moreover, while studying social responsibility as a factor of influence on vaccination attitudes, significant conclusions were drawn in studies as well (Korn et al., 2020). It was found that getting vaccinated is considered as a morally right behavior and unvaccinated individuals can face less generosity by others, especially vaccinated ones. Confidence about efficiency of the institutions and safety of the vaccinations play an important role as well. The 5C scale was used in a study of Dutch teenagers, and it was discovered that the safer the teenager believes the vaccine is, the more willing they are to get one. (Schulenburg, 2019).

Moving on to the discussion of more recent events, several studies have already been conducted, researching social norms and peer effect relation to COVID-19 vaccines. From study by Rohrer et al. (1954), it is apparent that people state group norm even after a year from the initial experiment. In one of the studies done among college students on their COVID vaccination intentions and attitudes (Scott, Graupensperger et al., 2021), it was found that if the student believed that typical young adults are going to get vaccinated at great rate, they were more willing to get vaccinated as well. Similar result was found in the study among youth of the United Kingdom, stating that they will be more willing to get vaccinated if majority does as well (Sinclair, Agerström, 2021). Additionally, in the study among US adults, researchers also found supporting evidence to our question – that there is influence of the social norms on vaccination attitudes and that norms predict vaccine hesitancy (Anna E. Jaffe et al., 2022). In another study, carried out in the six lower- and middle-income countries, it was also found that close family members and acquaintances have a significant influence on one's decision on getting a COVID-19 vaccine (Thomas P. Davis Jr. et al., 2022).

For this experiment, 5C scale was adopted to analyse attitudes of participants. The scale was developed by Betsch et al. (2018) and contributed to the structure of methodology of this study.

3. Data & Methodology

Data and Participants

The 5C vaccination scale intends to explore vaccine hesitancy and acceptance (Betsch, et al.), which includes Confidence-attitude toward vaccination, Complacency-perception of disease

risk, Constraint-self-control, Calculation-information searching involvement, and Collective responsibility-willingness to protect others (Appendix 2.3). The determinants of the 5C Scale are normalized from a 7-point Likert scale to a 0-1 scale for logical interpretation. The online survey was carried out at Philipps-University Marburg, with both students and faculty members participating. After two rounds of surveys, there are a total of 1240 responses: 722 responses in the *Control Treatment* survey, 277 responses in the *Peer Treatment* Survey, and 241 responses in the *Anchoring Treatment* survey.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
5C Scale					
Confidence	1240	.836	.2	.143	1
Complacency	1240	.188	.124	.143	1
Constraints	1240	.217	.165	.143	1
Calculation	1240	.749	.258	.143	1
Collective Responsibility	1240	.195	.145	.143	1
Age	1240	28.177	10.421	17	70
Gender	.	.	.	.	.
Divers	1240	.011	.106	0	1
Female	1240	.694	.461	0	1
Male	1240	.295	.456	0	1
Marriage	.	.	.	.	.
No	1240	.852	.356	0	1
Yes	1240	.148	.356	0	1
Children	.	.	.	.	.
No	1240	.875	.331	0	1
Yes	1240	.125	.331	0	1

Survey Procedure

As previously stated, vaccination attitudes are measured in this study using the 5C psychological antecedents of vaccination (Betsch, et al., 2018). Furthermore, three treatments were carried out: *Control, Peer*, and *Anchoring*. The first treatment, *Control*, consists solely of the original 5C Scale statements and no additional stimulus factors. As stimulus factors for *Peer* and *Anchoring Treatments*, we included graphs depicting the average 5C Scale results of previous surveys. The additional stimulus factors in the *Peer and Anchoring Treatments* are intended to determine whether participants' vaccination attitude responses are biased when shown the results of their peers. For this purpose, we conducted a two-round online survey, with each round lasting five days. We collected responses from university participants for our control treatment in the first round. In the second round, participants were randomly assigned to either the Peer or Anchoring treatment surveys. The average 5C Scale results from the *Control treatment* survey are used as stimulus factors in the *Peer treatment* survey, while the average 5C Scale results from Germany are used in the Anchor treatment survey (data source: COVID-19 Snapshot Monitoring-COSMO). Each survey is divided into two sections. Section 1 includes eight demographic questions such as gender, age, marital status, children, etc (detailed survey in Appendix 2.2). Section 2 involves eliciting participants' vaccination attitudes

by requiring them rate five vaccination attitude statements on a 7-point Likert scale (agree/disagree).

Empirical method

The association of vaccination attitudes and the effect of three treatment groups is investigated using linear regression. The regression model is stated as follows:

$$VA_{i,j} = \beta_0 + \beta_1 T_j + \beta_2 Age_j + \beta_3 Marriage_j + \beta_4 Children_j + u \quad (1)$$

In equation (1), $VA_{i,j}$ is the exploratory variable, with VA denotes vaccination 5C Scale's i determinants (Confidence, Constraints, Complacency, Calculation, Collective Responsibility) of individual j. T is binary variable of Treatment Group (e.g., observations with Peer or Anchoring treatment = 1, Control = 0). *Age*, *Marriage* and *Children* are independent variables of individual j. Using this structure we investigated the following Hypotheses:

Hypothesis 1: $Respondents' \ vaccination \ attitudes \ are \ biased \ when \ they \ see \ the \ results \ of \ their \ peers \ before \ answering.$

Hypothesis 2: $When \ shown \ the \ results \ of \ a \ large \ group \ (anchoring) \ before \ answering, respondents' \ answers \ are \ biased.$

Furthermore, we examined the t-statistic test for each 5C Scale determinant and the treatment groups separately to see how different the responses of individual determinants were in the control, peer, and anchor treatment groups with and without gender factor. Considering various factors, we propose the following hypotheses:

Hypothesis 3: $There \ is \ a \ significant \ difference \ in \ responses \ between \ the \ Control \ and \ Anchor \ (Peer) \ treatments.$

Hypothesis 4: $There \ is \ a \ significant \ difference \ in \ responses \ between \ the \ Control \ and \ Anchor \ (Peer) \ treatments \ considering \ respondents' \ gender.$

Hypothesis 5: $There \ is \ a \ significant \ difference \ in \ responses \ between \ the \ Peer \ and \ Anchor \ treatments.$

To test the posed hypotheses, we will first demonstrate our results and then continue to discuss them in context with our study aim.

4. Results

In this section, we will present the significant results we found during our data analysis. We investigated the relationship between the determinants of the 5C scale - namely Confidence,

Complacency, Constraints, Calculation, and Collective Responsibility – and effects of variables such as age, marital status, and treatment effect. Table 2 illustrates the results of the linear regressions considering demographic factors and peer effects on the individual determinants of the 5C scale. While we overall found rather low goodness of fit, our data shows various significant effects of different variables on the determinants of vaccination attitude.

Table 2: Linear regression
Peer and demographic effects on determinants of the 5C scale

VARIABLES	(P1) Confidence	(P2) Complacency	(P3) Constraints	(P4) Calculation	(P5) Collective Responsibility
Peer_Treatment (control=0; peer=1)	-0.0232 (0.0142)	-0.0192** (0.00762)	-0.0357*** (0.0105)	0.0285 (0.0175)	-0.00962 (0.0105)
Age	-4.04e-05 (0.000907)	-0.000230 (0.000567)	-0.00126** (0.000595)	0.00319*** (0.000977)	-0.000594 (0.000623)
Marriage (no=0; yes=1)	0.0769*** (0.0289)	-0.0164 (0.0197)	0.00287 (0.0208)	-0.0144 (0.0298)	-0.0193 (0.0210)
Children (no=0; yes=1)	-0.0933*** (0.0348)	0.0496* (0.0255)	-0.0100 (0.0223)	0.0468 (0.0334)	0.0306 (0.0312)
Constant	0.842*** (0.0238)	0.198*** (0.0151)	0.266*** (0.0170)	0.648*** (0.0276)	0.219*** (0.0178)
Observations	999	999	999	999	999
R-squared	0.015	0.013	0.015	0.026	0.003

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In regression (P1) we found that the effects of the variables *Marriage* and *Children* on the *Confidence* variable are significant. A one unit increase in M*arriage*, meaning the respondent stated that they are married, on average lead to a 0.0769 increase in *Confidence* at a 1% significance level. A one unit increase in *Children*, meaning the respondent stated that they have children, on average lead to a -0.0933 decrease in *Confidence* at a 1% significance level. In regression (P2) we found that the effects of the variables *Peer_Treatment* and *Children* on the *Complacency* variable are significant. A one unit increase in *Peer_Treatment*, meaning the respondent was presented the results of their peers before answering, on average leads to a -0. 0192 decrease in *Complacency* at a 5% significance level. A one unit increase in *Children* on average lead to a 0.0496 increase in *Complacency* at a 10% significance level. In regression (P3) we found that the effects of the variables *Peer_Treatment and Age* on the *Constraints* variable are significant. A one unit increase in *Peer_Treatment* on average lead to a -0.0357 decrease in *Constraints* at a 1% significance level. A one unit increase in *Age* on average lead to a -0.00126 decrease in *Constraints* at a 5% significance level. In regression (P4) we found that the effect of the variable *Age* on the *Calculation* variable is significant. A one unit increase in *Age* on average lead to a 0.00319 increase in *Calculation* at a 1%

significance level. In regression (P5) we found no significant effect of the shown variables on *Collective Responsibility.*

Table 3 shows the results of our linear regressions considering demographic and anchoring effects on the individual determinants of the 5C scale. Our data shows various significant effects of variables on the determinants of vaccination attitude. In regression (A1) we found that the effects of the variables *Marriage* and *Children* on the *Confidence* variable are significant. A one unit increase in *Marriage* on average lead to a 0.0512 increase in *Confidence* at a 10% significance level. A one unit increase in *Children* on average lead to a -0.0839 decrease in *Confidence* at a 5% significance level. In regression (A2) we found that the effects of the variables *Anchor_Treatment* and *Children* on the *Complacency variable* are significant. A one unit increase in *Anchor_Treatment*, meaning the respondent was presented an anchoring point (the German average answer) before answering, on average lead to a -0.0156 decrease in *Complacency* at a 10% significance level. A one unit increase in *Children* on average lead to a 0.0562 increase in *Complacency* at a 5% significance level. In regression (A3) we found that the effect of the variable *Anchor_Treatment* on the *Constraints* variable is significant. A one unit increase in *Anchor_Treatment* on average lead to a -0.0259 decrease in *Constraints* at a 5% significance level. In regression (A4) we found that the effect of the variable *Age* on the *Calculation* variable is significant. A one unit increase in *Age* on average lead to a -0.00378 decrease in *Calculation* at a 1% significance level.

Table 3: Linear regression
Anchoring and demographic effects on determinants of the 5C scale

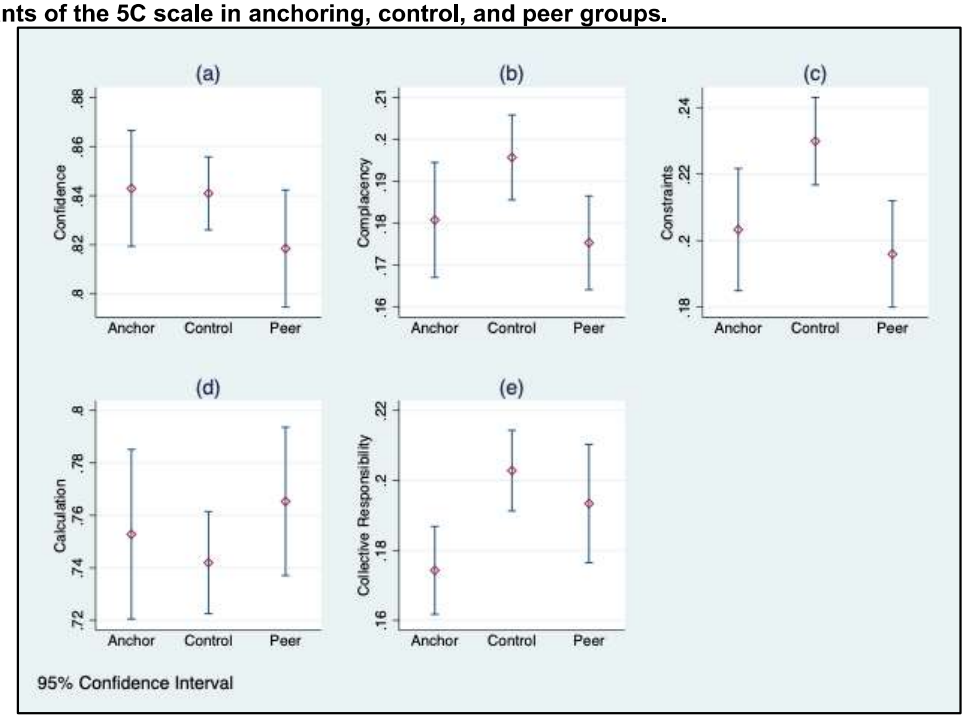
VARIABLES	(A1) Confidence	(A2) Complacency	(A3) Constraints	(A4) Calculation	(A5) Collective Responsibility
Anchor_Treatment (control=0; anchor=1)	0.00227	-0.0156*	-0.0259**	0.00742	-0.0282***
	(0.0142)	(0.00860)	(0.0115)	(0.0190)	(0.00870)
Age	0.000168	-0.000672	-0.000664	0.00378***	-0.000491
	(0.000812)	(0.000530)	(0.000757)	(0.000915)	(0.000490)
Marriage (no=0; yes=1)	0.0512*	-0.00207	-0.00248	-0.0104	-0.0237
	(0.0300)	(0.0208)	(0.0214)	(0.0279)	(0.0164)
Children (no=0; yes=1)	-0.0839**	0.0562**	-0.00345	0.0210	0.0357*
	(0.0340)	(0.0239)	(0.0226)	(0.0297)	(0.0217)
Constant	0.839***	0.208***	0.250***	0.634***	0.216***
	(0.0214)	(0.0143)	(0.0204)	(0.0264)	(0.0145)
Observations	963	963	963	963	963
R-squared	0.010	0.016	0.007	0.027	0.011

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In regression (A5) we found that the effects of the variables *Anchor_Treatment* and *Children* on the *Collective Responsibility* variable are significant. A one unit increase in

Anchor_Treatment on average lead to a -0.0282 decrease in *Collective Responsibility* at a 1% significance level. A one unit increase in *Children* on average lead to a 0.0357 increase in *Collective Responsibility* at a 10% significance level. Figure 1 shows the interval plots of the determinants of the 5C scale. It shows the mean value for each determinant by treatment group, and the variation within each group. Visually, smaller intervals show more consistent data and less variation, while larger intervals indicate higher variation. If there is an overlap between groups, we are unable to conclude that there are differences between them at a 95% significance level. We used these graphs to analyze our data graphically and were able find some areas without overlapping confidence intervals in the plots for the determinants *Complacency,* represented by plot (c), and *Collective Responsibility*, represented by plot (e). In plot (c) we can see that the intervals of the control and peer group do not show an overlap, indicating that respondents' answers to our question on *Constraints* were on average lower in the peer group than in the control group. Similarly, in plot (e) we can see that the intervals of the control and anchoring group do not overlap, indicating that respondents' answers to our question on *Collective Responsibility* were on average lower in the anchoring group than in the control group. It is also to note that while not entirely significant at this level, there is only a minimal interval overlap of control and peer group in plot (b), weakly indicating that respondents' answers to our question on *Complacency* were on average lower in the peer group than in the anchoring group.

Figure 1: Interval plots
Determinants of the 5C scale in anchoring, control, and peer groups.



Given that all intervals of anchoring and peer group overlap, there are no significant differences when comparing respondents' answers between anchoring and peer groups in our data.

We tested these graphical results by conducting t-tests, which can be found in Appendix 2. Furthermore, we conducted additional t-tests with concern to the variable *Gender*, which can be seen in the tables below. In these tables, we formulate similar null-hypotheses (there is no difference in determinants of the 5C scale between groups) and test them in with regard to the determinants of the 5C scale while controlling for specific respondent groups. In Table 4 we can see that when testing for differences between control and peer group in female respondents only, we found that there are weakly significant results in the *Confidence* and *Constraints* variables. Thus, at a 10% significance level, we can reject their individual null hypotheses and conclude that there may be a difference between respondents' answers to our questions on *Confidence* and *Constraints* between women in the control and peer group.

Table 4: T-test
Null-Hypothesis: "No difference in [variable] between control and peer treatment groups" when controlling for Gender=female

variable	Control Obs	Peer Obs	Mean (control)	Mean (peer)	dif	SE	t	p
Confidence	520	180	.841	.81	.03	.018	1.75	.083
Complacency	520	180	.193	.178	.014	.011	1.3	.199
Constraints	520	180	.229	.202	.026	.015	1.8	.072
Calculation	520	180	.742	.749	-.007	.022	-.3	.748
Collective Responsibility	520	180	.191	.195	-.005	.012	-.4	.705

At a p-value smaller than 0.05 we can reject the Null Hypothesis, meaning there is a difference in [variable] between control and peer survey.

In Table 5, when testing for differences between control and peer group in male respondents only, we found that there are significant results in the *Complacency* and *Constraints* variables and a weakly significant result in the *Collective Responsibility* variable. Thus, at differing significance levels, we can reject the null hypotheses and conclude that there may be a difference between respondents' answers to our questions on *Complacency*, *Constraints,* and *Collective Responsibility* between men in the control and peer group.

Table 5: T-test
Null-Hypothesis: "No difference in [variable] between control and peer treatment groups" when controlling for Gender=male

variable	Control Obs	Peer Obs	Mean (control)	Mean (peer)	dif	SE	t	p
Confidence	195	94	.844	.841	.004	.025	.15	.887
Complacency	195	94	.202	.164	.037	.015	2.4	.018
Constraints	195	94	.235	.185	.049	.021	2.35	.018
Calculation	195	94	.742	.793	-.052	.033	-1.55	.12
Collective Responsibility	195	94	.227	.19	.037	.022	1.7	.086

At a p-value smaller than 0.05 we can reject the Null Hypothesis, meaning there is a difference in [variable] between control and peer survey.

Table 6 shows the t-test for differences between control and anchoring group in female respondents only, we found that there is only one significant result in the *Constraints* variable.

Thus, at a 5% significance level, we can reject the null hypotheses and conclude that there may be a difference between respondents' answers to our question on *Constraints* between women in the control and anchoring group.

Table 6: T-test
Null-Hypothesis: "No difference in [variable] between control and anchoring treatment groups" when controlling for Gender=female

variable	Control Obs	Anchoring Obs	Mean (anchoring)	Mean (control)	dif	SE	t	p
Confidence	520	160	.845	.841	.004	.018	.2	.834
Complacency	520	160	.173	.193	-.019	.011	-1.7	.09
Constraints	520	160	.198	.229	-.031	.015	-2	.045
Calculation	520	160	.74	.742	-.002	.024	-.1	.938
Collective Responsibility	520	160	.165	.191	-.026	.011	-2.25	.026

At a p-value smaller than 0.05 we can reject the Null Hypothesis, meaning there is a difference in [variable] between control and anchoring survey.

In Additional Table 4 in Appendix 2 we can see that when testing for differences between control and anchoring group in male respondents only, we found that there are no significant results in the determinants of the 5C scale. Thus, we cannot reject the null hypotheses at any reasonable significance level and conclude that there may not be any differences between respondents' answers to our question on men the control and anchoring group.

5. Discussion & Conclusion

After showing our results, we will now discuss them in context with the Hypotheses we posed in our research. Hypothesis 1 concerned itself with a possible bias in vaccination attitude when respondents were shown the results of their peers before answering. In our regressions we found that the peer treatment had a significant negative effect on the variables *Complacency* and *Constraints*. When considering *Complacency*, a lower value means respondents perceive vaccinations as less unnecessary, which we interpret as a more positive vaccination attitude (pro-vaccination attitude). When considering *Constraints*, a lower value means that respondents perceive everyday stress as a lower obstacle to getting vaccinated, which increases the likelihood of them getting vaccinated (pro-vaccination attitude). Thus, we found that our peer treatment seems to have had a positive effect on vaccination attitude, confirming our first hypothesis which is in line with some of the literature (Thomas P. Davis Jr. et al.; Sinclair, Agerström). When considering the demographical factors in the regressions using our peer treatment (Table 2), we found some other relevant results. When shown the responses of their peers, respondents who stated they were married were generally more confident in the safety of vaccines, while participants who stated they had children had a generally less positive vaccination attitude. We also find that with increasing age, participants stated lower constraints and were more likely to ponder possible costs and benefits of vaccines, which may indicate a

higher probability to get vaccinated.

Considering hypothesis 2, which concerned itself with a possible bias in vaccination attitude when respondents were shown an anchoring point before answering, we found somewhat similar results. Our regressions show that the anchoring treatment had a significant negative effect on the variables *Complacency*, *Constraints*, and *Collective Responsibility*. When considering *Collective Responsibility*, a lower value means respondents may perceive a higher social responsibility to get vaccinated (pro-vaccination attitude). Thus, we found that our anchoring treatment seems to have had a positive effect on vaccination attitude, confirming our second hypothesis. This is in line with previously found results of studies on vaccinations becoming moral obligation regarding social responsibility (Korn et al., p. 8). When considering the demographical factors in the regressions using our anchoring treatment (Table 3), we found some other relevant results. When shown the anchoring point, respondents who stated they were married were generally more confident in the safety of vaccines, while participants who stated they had children had a generally less positive vaccination attitude. We also find that with increasing age, participants were more likely to ponder possible costs and benefits of vaccines, which may indicate a higher general willingness to educate themselves about vaccines and thus probability to get vaccinated.

In hypothesis 3 we argued that there are significant differences in responses between control and anchoring treatment, as well as between control and peer treatment. In our t-tests regarding this hypothesis (see Appendix 2) we found that there are significant (negative) differences in responses between control and anchoring treatments in the variables *Constraints* and *Collective Responsibility*. When considering the peer treatment aspect of this hypothesis, we found that there are significant (positive) differences in responses between control and peer treatments in the variables *Complacency* and *Constraints*. Thus, we find that both anchoring and peer treatments induced a difference in responses, confirming our third hypothesis.

With hypothesis 4 we investigated possible differences in respondents' answers when considering their gender. In our t-tests regarding this hypothesis, we found that there are significant (negative) differences in responses of female participants between control and anchoring treatments in the variables *Complacency*, *Constraints*, and *Collective Responsibility*. Given that lower values in *Complacency*, *Constraints*, and *Collective Responsibility* indicate a generally more positive attitude towards vaccination, our results suggest that women who were shown the anchoring point may on average have a more positive attitude towards vaccinations. When considering the peer treatment aspect of this hypothesis, we found that there are only weakly significant differences in responses of female participants between control and peer

treatments in the variables *Confidence* and *Constraints*. Meanwhile, the responses of male participants showed (positive) significant differences in the variables *Complacency* and *Constraints*. Given that higher values in *Complacency* and *Constraints* indicate a generally less positive attitude towards vaccination, our results suggest that men who were shown the results of their peers may on average have a more negative attitude towards vaccinations.

Considering hypothesis 5, which concerned itself with showing a significant difference in responses between peer and anchoring treatments, we found only a single, weakly significant difference in respondents' answers on *Collective Responsibility*. Thus, when deciding on whether to confirm or reject our hypothesis we must be careful. Given that our findings were only weakly significant, we chose to reject our fifth hypothesis, meaning that there may not be a significant difference ins responses between peer and anchoring treatments. When taking this result into considerations, we found one major limitation of our study.

Since we do not find a significant difference between our peer and anchoring treatment, it may be possible that they describe the same effect, or that both effects are distinguished but similar in nature. Further research is required to fully investigate these treatment effects and possibly differentiate between them, though this is beyond the scope of this seminar paper. In conclusion, we found that both peer effect and anchoring effect were affecting our participants in their answers on vaccination attitude, showing evidence that their decisions could be influenced through such effects. Keeping that in mind, it may not be possible to completely remove participants from such external factors in survey, as we have no control over their behaviour outside of the experiment.

Appendix 1: List of References

1. Anna E. Jaffe, Scott Graupensperger, Jessica A. Blayney, Jennifer C. Duckworth, Cynthia A. Stappenbeck, 2022, *"The Role of Perceived Social Norms in College Student Vaccine Hesitancy: Implications for COVID-19 Prevention Strategies"*, Public Health Emergency Collection
2. Betsch C, Schmid P, Heinemeier D, Korn L, Holtmann C, Bo¨hm R (2018) Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. PLoS ONE 13(12): e0208601. https://doi.org/ 10.1371/journal.pone.0208601
3. Brunson, E. K., 2013, *"The Impact of Social Networks on Parents' Vaccination Decisions"*, Pediatrics, 131, 1397–1407
4. COVID-19 Snapshot Monitoring (COSMO) - www.corona-monitor.de. Retrieved from: https://projekte.uni-erfurt.de/cosmo2020/archiv/16-01/cosmo-analysis.html
5. Cialdini Robert B., Trost Melanie R., 1998, *"Social Influence: Social Norms, Conformity, and Compliance"*, p.152
6. Korn L., Böhm R., Meier N.W., Betsch C., 2020, *"Vaccination as a Social Contrract"*, PNAS Vol. 117, No. 26
7. Leight J., Safran E., 2019, *"Increasing Immunization Compliance Among Schools and Day Care Centers: Evidence from a Randomized Controlled Trial"*, Journal of Behavioral Public Administration, Vol 2(2), pp. 1-15
8. Oraby Tamer, Thampi Vivek, Chris T. Bauch, 2014, *"The Influence of Social Norms on the Dynamics of Vaccinating Behaviour for Paediatric Infectious Diseases"*, Proceedings B
9. Rohrer J. H., Baron S. H., Hoffman E. L., Swander D.V., 1954, *"The Stability of Autokinetic Judgments"*, Journal of Personality and Social Psychology, 51, 770-778, cross-reference from Cialdini Robert B., Trost Melanie R., 1998, *"Social Influence: Social Norms, Conformity, and Compliance"*, p.154-155
10. Schulenburg L. C. M., 2019, *"The Intention of Dutch Teenagers': Getting Vaccinated or Not?"*, Master Health Sciences, University of Twente and GGD Twente
11. Scott Graupensperger, PhD., Devon A. Abdallah, Christine M. Lee, 2021, *"Social Norms and Vaccine Uptake: College students' COVID Vaccination Intentions, Attitudes, and Estimated Peer Norms and Comparisons with Influenza Vaccine"*, US National Library of Medicine, Public Health Information
12. Sherif M., 1936, *"The Psychology of Social Norms"*, New York: Harper, cross-reference from Cialdini Robert B., Trost Melanie R., 1998, *"Social Influence: Social Norms,*

Conformity, and Compliance", p.154

13. Sinclair Samantha, Agerström Jens, 2021, *"Do Social Norms Influence Young People's Willingness to Take the COVID-19 Vaccine?"*, Health Communication
14. Sturm L., Mays R., Zimet G., 2005, *"Parental Beliefs and Decision Making About Child and Adolescent Immunization: From Polio to Sexually transmitted infections"*, J Dev Behav Pediatr., 26(6), 441-4452, cross-reference from Baeza-Rivera M.J., Salazar-Fernández C., Araneda-Leal L., Manríquez-Robies D., 2021, *"To Get Vaccinated or Not? Social Psychological Factors associated with Vaccination Intent for COVID-19"*, Journal of Pacific Rim Psychology
15. Thaker Jagadish, Ganchoudhuri Somrita, 2021, *"The Role of Attitudes, Norms, and Efficacy of Shifting COVID-19 Vacine Intentions: A longitudinal Study of COVID-19 Vaccination Intentions in New Zealand"*, Special Issue Factors Associated with Vaccine Hesitancy
16. Thomas P. Davis Jr., Adugna Kebede Yimam, Md Abul Kalam, Asrat Dibaba Tolossa, Robert Kanwagi, Sarah Bauler, Loria Kulathungam, Heidi Larson, 2022, *"Behavioral Determinants of COVID-19-Vaccine Acceptance in Rural Areas of Six Lower- and Middle-Income Countries"*, US National Library of Medicine, Public Health Information
17. Tung Thanh Le, Jakob P. Cramer, Robert Chen, Stephen Mayher, 2020, *"Evolution of the COVID-19 Vaccine Development Landscape"*, Nature Reviews: Drug Discovery, Vol. 19, pp. 667-668

Appendix 2: Additional Material

Appendix 2.1: Tables

Additional Table 1: T-test results of Null-Hypothesis: "No difference in [variable] be between control and peer treatment groups"

variable	Control Obs	Peer Obs	Mean (control)	Mean (peer)	dif	SE	t	p
Confidence	722	277	.841	.819	.022	.015	1.55	.118
Complacency	722	277	.196	.176	.021	.009	2.25	.025
Constraints	722	277	.23	.196	.034	.012	2.85	.005
Calculation	722	277	.742	.766	-.024	.018	-1.25	.203
Collective Responsibility	722	277	.203	.194	.009	.011	.85	.387

At a p-value smaller than 0.05 we can reject the Null Hypothesis, meaning there is a difference in [variable] between control and peer survey.

Additional Table 2: T-test results of Null-Hypothesis: "No difference in [variable] between control and anchoring treatment groups"

variable	Control Obs	Anchoring Obs	Mean (control)	Mean (anchor)	dif	SE	t	p
Confidence	722	241	.843	.841	.002	.015	.15	.893
Complacency	722	241	.181	.196	-.015	.01	-1.5	.129
Constraints	722	241	.204	.23	-.026	.013	-2.1	.038
Calculation	722	241	.753	.742	.011	.019	.55	.581
Collective Responsibility	722	241	.175	.203	-.029	.011	-2.65	.009

At a p-value smaller than 0.05 we can reject the Null Hypothesis, meaning there is a difference in [variable] between control and anchoring survey.

Additional Table 3: T-test results of Null-Hypothesis: "No difference in [variable] between peer and anchoring treatment groups"

variable	Anchoring Obs	Peer Obs	Mean (anchor)	Mean (peer)	dif	SE	t	p
Confidence	241	277	.843	.819	.025	.017	1.45	.154
Complacency	241	277	.181	.176	.005	.009	.6	.54
Constraints	241	277	.204	.196	.007	.013	.6	.551
Calculation	241	277	.753	.766	-.013	.022	-.6	.564
Collective Responsibility	241	277	.175	.194	-.019	.011	-1.75	.082

At a p-value smaller than 0.05 we can reject the Null Hypothesis, meaning there is a difference in [variable] between anchoring and peer survey.

Additional Table 4: T-test results of Null-Hypothesis: "No difference in [variable] between control and anchoring treatment groups" when controlling for Gender=male

variable	Control Obs	Anchoring Obs	Mean (anchoring)	Mean (control)	dif	SE	t	p

Confidence	195	77	.837	.844	-.007	.028	-.25	.795
Complacency	195	77	.197	.202	-.005	.019	-.25	.799
Constraints	195	77	.219	.235	-.015	.024	-.65	.516
Calculation	195	77	.785	.742	.044	.036	1.2	.232
Collective Responsibility	195	77	.189	.227	-.038	.023	-1.65	.101

At a p-value smaller than 0.05 we can reject the Null Hypothesis, meaning there is a difference in [variable] between control and anchoring survey.

Appendix 2.2: Survey Questions

[…] The text in brackets is the detailed explanation, which will not be displayed on the screen during the online survey.

[Three separate surveys for the Anchoring, Peer, and Control groups were conducted. Part 1 is always the same for all. In Part 2, the statements are also the same, but with the anchoring and peer survey adding a diagram/graph.]

***

Vaccination Attitude Survey

Thank you for participating in our survey on vaccination attitude. Your responses will help us in better understanding people's reactions and attitudes towards vaccination. This survey should take approximately 3-5 minutes to complete. All questions and statements require a response, and it will be kept strictly confidential.

Information for participants

Voluntariness and anonymity

Participation in this study is voluntary. You may terminate your participation in the study at any time without giving any reason and without incurring any disadvantage. All information will be kept strictly confidential. Only individuals directly involved in the study will have access to the raw data and are also bound by confidentiality. The data will be used completely anonymously for statistical analyses and for scientific purposes. The results of the study will also be published anonymously, i.e., your data cannot be assigned to you personally. It is not possible to draw any conclusions about your person based on the information you provide. The anonymity of the data is guaranteed.

Data protection

The collection of your personal data described above is completely anonymous, i.e., at no point will your name or other data be requested that could be used to draw conclusions about your person. Your answers and results are stored under a personal code word. This means that it is not possible for anyone to associate your data with your name. The storage period for the completely anonymized data is the same as the duration of the study. However, you may request deletion of the data collected from you whenever you wish.

If you have any questions or encounter difficulties, you can contact the study management (Brockn*,

Mammadli*, Tonnu*) at any time.

*@students.uni-marburg.de

Part 1: Personal questions

First and foremost, we'd like to ask you some personal questions. We ensure that all of your information is kept anonymously and that only experimenters have access to your data.

Before you start, we kindly ask you to create your own personal code as our instructions. By generating a personal code, we would like to avoid duplicating inputs.

* First letter of your father's first name (e.g., Steve Roger, input: S)
* Your mother's day of birth without month and year (D.O.B. : 08.02.2022, input: 08)
* Your father's day of birth without month and year (D.O.B. : 01.02.2022, input: 01)
* First letter of your birth place (city) (e.g. Lepzig, input: L)
* Example: S0801L (all letters in UPPERCASE).

- _____ *[short answer]*

1. Gender
   - Female
   - Male
   - Other
2. How old are you?
   - _____ [short answer]
3. What is your highest level of education?
   - High school (Abitur)
   - Undergraduate (Bachelor's degree)
   - Graduate (Master's degree)
   - PhD
4. Please specify your ethnicity
   - White
   - Hispanic or Latino
   - Black or African American
   - Native American or Indigenous People
   - Asian / Pacific Islander
5. Which field of study are you in?
   - Humanities
   - Social Sciences
   - Natural Sciences
   - Formal Sciences
   - Professions and applied sciences
   - Other: _____

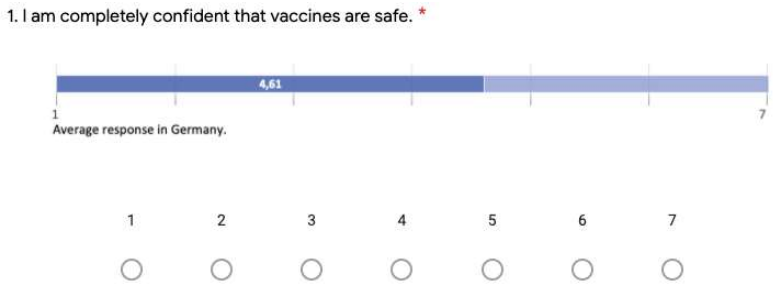
6. Are you married?
   - Yes
   - No
7. Do you have children?
   - Yes
   - No
8. What is your annual household income?
   - < 6.000€
   - 6.001 - 10.000€
   - 10.001 - 14.000€
   - 14.001 - 18.000€
   - 18.001 € - 22.000€
   - > 22.000€

Part 2: Vaccination Attitude

[ALTERNATIVE SURVEY VERSION 1: Anchoring Survey

Here a diagram displaying the overall responses to these 5C vaccination antecedents in Germany will be shown.

For example:

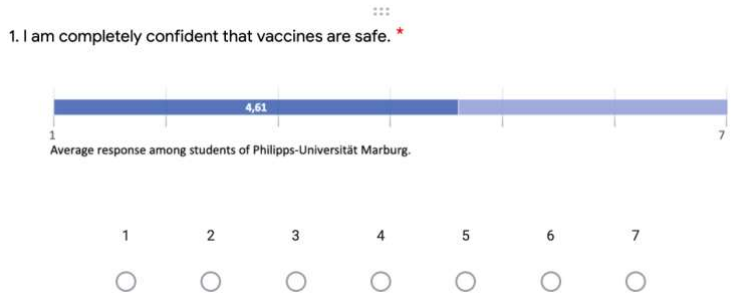


This Anchoring survey will be distributed alongside the control survey, with participants answering either the control OR anchoring survey.]

[ALTERNATIVE SURVEY VERSION 2: Peer Survey

Here a diagram displaying the overall responses to these 5C vaccination antecedents from the control group (which represents our peer group) will be shown.

For example:



This peer survey will be distributed as soon as the Anchoring and Control surveys are completed.]

Please state to what extent you agree or disagree with the following statements:

1. I am completely confident that vaccines are safe.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
2. Vaccine-preventable diseases are not so severe that I should be vaccinated.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
3. Everyday stress prevents me from being vaccinated. For me, it is inconvenient to be vaccinated.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
4. It is important for me to fully understand the topic of vaccination before I get vaccinated.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
5. When everyone else is vaccinated, I don't have to be vaccinated too.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

Appendix 2.3: The 5C Psychological Antecedents of Vaccination (5C Scale)

Betsch C, Schmid P, Heinemeier D, Korn L, Holtmann C, Böhm R (2018) Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. PLoS ONE 13(12): e0208601. https://doi.org/ 10.1371/journal.pone.0208601

Confidence

- **I am completely confident that vaccines are safe.**

Complacency

- **Vaccination is unnecessary because vaccine-preventable diseases are not common anymore.**

Constraints

- **Everyday stress prevents me from getting vaccinated.**

Calculation

- **When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible.**

Collective responsibility

- **When everyone is vaccinated, I don't have to get vaccinated, too.**

Statutory Declaration

I herewith declare that I have composed the present term paper myself and without use of any other than the cited sources and aids. Sentences or parts of sentences quoted literally are marked as such; other references with regard to the statement and scope are indicated by full details of the publications concerned. The term paper in the same or similar form has not been submitted to any examination body and has not been published.

Nha Trang Ton Nu | Farida Mammadli | Niklas Brock

Marburg, March 20th, 2022