Determinants of Vaccine Hesitancy: the Influence of Factors of the Protection Motivation Model and Health Condition on People's Hesitant Attitude Towards Covid-19 Vaccines

Sophia Paczulla

Department of Psychology of Conflict, Risk and Safety

University of Twente

Dr M. W. M. Kuttschreuter

F. G. Boerkamp

01st of July 2021

Abstract

The current situation given by the coronavirus required great sacrifices all over the world. Not only are society, economy, and mental health impacted but also did the virus cause the death of a great number of people. Vaccinations against the virus are thus providing hope for an improvement of the situation. However, in the Netherlands and Germany, part of the population shows an unwillingness to get vaccinated. Given this background, this study aimed to investigate the extent to which factors of the Protection Motivation Theory (PMT) and the current health condition of people do predict hesitant corona vaccination attitudes in people. Additionally, it was investigated to what extent these factors do predict corona vaccination intention. In particular, the predictors of vulnerability, severity, benefits of vaccination, social norm, response-efficacy, self-efficacy, response cost, and health condition built the model of this study. The results of the online questionnaire showed that all variables except response cost correlated negatively with vaccine hesitancy. Next to this, three regression analyses were done and showed that the whole model had a predictive power of 61.8% for vaccine hesitancy. Response-efficacy, benefits of vaccination, and response cost had the greatest predictive power in combination with all predictors. A similar result was found for vaccination intention, for which the model had a predictive power of 63.4%. The strongest predictors for vaccination intention were benefits of vaccination, response-efficacy, self-efficacy, health condition, and social norm. When including vaccine hesitancy into the model, the model explained 68.9% of the variance in vaccination intention. Then, the strongest predictors were vaccine hesitancy, benefits of vaccination, and self-efficacy in combination with the remaining predictors. Furthermore, no gender differences were identified regarding women's-and men's levels of vaccine hesitancy. Future recommendations included the use of a random sampling method and investigating the determinants that showed the highest correlation with vaccine hesitancy in more detail. Next to this, implications entailed implementing the findings of this study when constructing interventions that are aimed to reduce vaccination refusal.

Keywords: corona, covid-19, vaccine hesitancy, vaccination intention, Protection Motivation Theory, risk perception, risk communication

Determinants of Vaccine Hesitancy: the Influence of Factors of the Protection Motivation Model and Health Condition on People's Hesitant Attitude Towards Covid-19 Vaccines

The Covid-19 pandemic prompts severe consequences. Besides resulting in several deaths across the globe (WHO, n.d.), the pandemic also had its impact on domains such as society, economy (Khan et al., 2020), and mental health of people (Torales et al., 2020). The coronavirus can be considered different from other diseases as it originated from an animal, was transmitted to people, and is now transferable between people (Williams, 2020). Also, humans have not yet developed immunity, and vaccines against the virus had to be developed first (Williams, 2020). In contrast, the influenza virus, for instance, is less infectious, is only transmitted between humans, and is causing less serious illnesses than the corona virus (Centers for Disease Control and Prevention, 2021, June 07). Further research that focused on Covid-19 has shown that the virus is especially deadly on vulnerable populations in which management of the infection is inadequately handled (Dashraath et al. 2020).

To protect vulnerable populations, and to decrease the number of newly infected people, health care providers worldwide are trying to manage these consequences of the pandemic with, for example, subsidies, contact-, and exit restrictions, or penalties. Although governments are imposing these requirements strictly, corona cases are decreasing only slowly. Consequently, successful risk communication is needed. Risk communication can be defined as 'the interactive exchange of information about risks among risk assessors, managers, news media, interested groups, and the general public' (Muralikrishna & Manickam, 2017, p. 147), and is further described as 'any two-way communication between stakeholders about the existence, nature, form, severity, or acceptability of risks' (Muralikrishna & Manickam, 2017, p. 147). Thus, risk communication, in the light of the coronavirus, would imply proper information about potential risks of the virus and ways to combat it.

As of late 2020, public distribution of effective and safe vaccination against the virus has begun with being estimated to last until 2022 (Callaway, 2020, April 28). However, in the Netherlands, the unwillingness to get vaccinated against the corona virus was found to be around 14% of the Dutch population within the first quarter of 2021 (Centraal Bureau voor de Statistiek, 2021, May 26). Similarly, in Germany, the unwillingness to get vaccinated was around 14% in November 2020 but decreased to 9% in February 2021, and 6% in May 2021 (Radtke, 2021, May 19). Other researchers estimated the unwillingness to get vaccinated to

be as high as a quarter of the German population (Lazarus et al., 2020; Henley, 2021, February 04).

Governments cannot purely rely on the indication of willingness or intention to get vaccinated as there might be other factors influencing this behavioural decision as well. To be concrete, according to the Theory of Planned Behaviour, attitude was shown to play a role in the formation of behaviour (Ajzen, 1991). However, the relationship between attitude and behaviour can be considered a difficult one as studies that looked deeper into this relationship come up with inconsistent results. To be concrete, researchers found correlations between attitudes and behaviour in general ranging from -.20 (Leippe & Elkin, 1987) up to .73 (Fazio & Williams, 1986). Factors that can affect this relationship were found to be confidence, memorability, and direct experience. This means, when attitudes are held with confidence, are easy to recall, and are shaped based on direct rather than indirect experience, greater attitude-behaviour consistency can be expected (Kraus, 1995). Although the predictability of attitude on behaviour should be treated with caution, attitudes can be considered an essential factor in the formation of vaccine-hesitant behaviour as they can be shared with others.

In times of social media, information is more rapidly shared and spread than ever before (Bicen & Cavus, 2011; Osatuyi, 2013). Specifically, online information sharing was found to be linked to attitude-, and belief formation in general (Happer & Philo, 2013), but also, online anti-vaccination materials were linked to behavioural refusal of vaccination (Wilson & Wiysonge, 2020). Thus, when aiming to reduce vaccine-hesitant behaviour in a population, it might be advisable to investigate the determinants that form a vaccine-hesitant attitude. By this, negative vaccine attitudes could be changed into more accepting attitudes, and hence, rather accepting attitudes are shared (e.g., on social media). Consequently, the extent of vaccination refusal might be decreased as well.

Under the term vaccination attitudes, dispositions between full support and full hesitancy towards vaccines are grouped (Yaqub et al., 2014). Specifically, vaccine hesitancy *in the form of an attitude* has been described as ‘an expression of concern or doubt about the value or safety of vaccination’ (Yaqub et al., 2014). Attitude is often treated as an antecedent of intention, such as in the case of the Theory of Planned Behaviour (Ajzen, 1991), and has also been associated with intention in other studies that were concerned with corona vaccination attitudes and intentions. In these studies, it was shown that a hesitant vaccination attitude was negatively correlated with the intention to get vaccinated (Paul et al., 2021), and an accepting vaccination attitude was positively correlated with the intention to get

vaccinated (Chu & Liu, 2021). Hence, it appears that vaccination attitudes play a role in the formation of vaccination intention.

Vaccination intention can be defined as being 'absolutely certain or very likely to be vaccinated' (Centers for Disease Control and Prevention, 2021, February 11). As theories such as the Theory of Planned Behaviour (Ajzen, 1991) or the Protection Motivation Theory (Prentice-Dunn & Rogers, 1986) suggested, intention leads most likely to behaviour. Subsequently, it can be assumed that a non-intention to vaccinate would most likely lead to a behavioural refusal of vaccines, which entails not only the refusal of vaccination for oneself but is also implying the act of convincing others to refuse vaccination (Yaqub et al., 2014). Consequently, insights into what determines hesitant vaccination attitudes could be used to get a greater understanding of the unwillingness or non-intention to get vaccinated, which could then be used further to examine what determines vaccination refusal.

So far, critical determinants of a hesitant attitude towards corona vaccines that have been found are lower levels of education, lower annual income, poor knowledge of Covid-19, and poor compliance with government Covid-19 guidelines (Paul et al., 2021). Although determinants of vaccine hesitancy, in general, have been studied before the corona pandemic, factors for hesitant attitudes towards the Covid-19 vaccines are yet still a topic to be explored more in detail. There might be further psychological factors that should be investigated concerning their use as predictors for corona vaccine hesitancy in people.

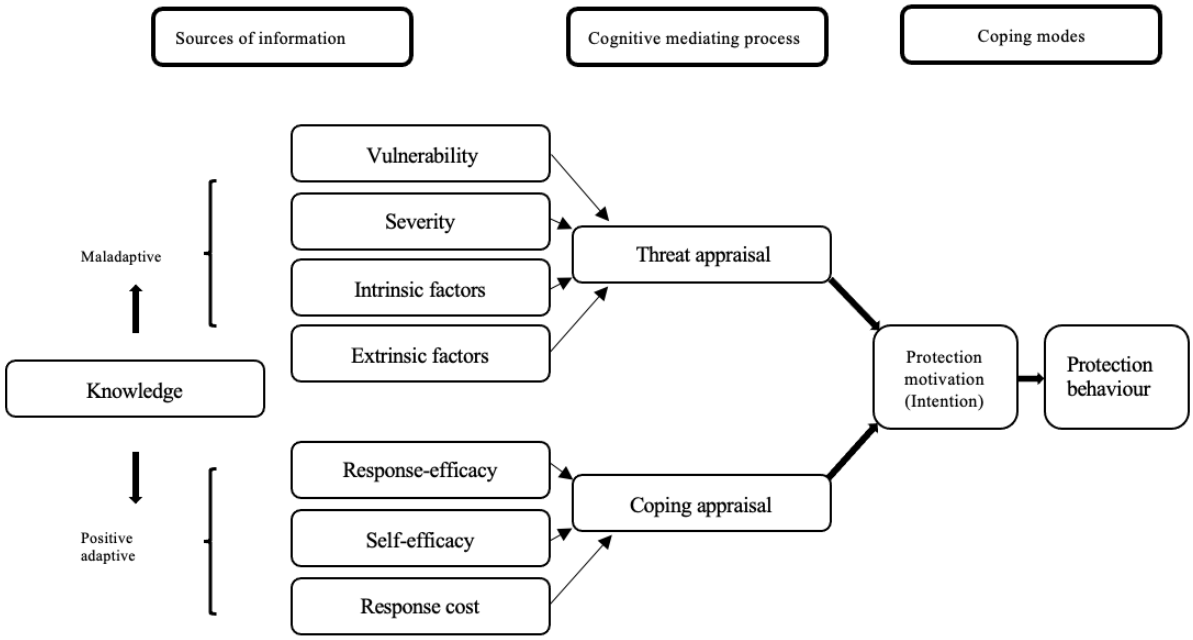
Theoretical Framework

Protection Motivation Theory

One theory that demonstrates how certain factors can influence health-promoting-, or health-threatening behaviour is the Protection Motivation Theory (PMT). Rogers originally proposed this theoretical model in 1975 to clarify mechanisms by which people adopt protective behaviours to reduce perceived threat (Rogers, 1975), and it has been revised several times (Rogers, 1983; Prentice-Dunn & Rogers, 1986). After one of Roger's revisions in 1983, the PMT resulted in a theory consisting of three basic constructs: sources of information, cognitive mediating process, and coping modes. Various sub-constructs are underlying these constructs: knowledge, vulnerability, severity, intrinsic factors, extrinsic factors, response-efficacy, self-efficacy, response cost, protection motivation/ intention, and protection behaviour (Prentice-Dunn & Rogers, 1986). In the following, these constructs will be applied to the coronavirus and will be explained in further detail (see also Figure 1).

Figure 1

Schematic Representation of the Protection Motivation Model



To start, the coping appraisal of the PMT explains a decrease or increase of an adaptive response towards the coronavirus, which could be the act of getting vaccinated. The coping appraisal incorporates three constructs, namely, response-efficacy, self-efficacy, and response cost. Response-efficacy refers to the judgement of whether the vaccination against the virus will be efficient enough to avoid a possible corona infection. Self-efficacy describes the judgement of one's own ability to get vaccinated. Next, response cost refers to perceived hurdles, e.g., inconvenience or difficulty, that need to be overcome to receive a corona vaccination. Response-efficacy and self-efficacy increase the likelihood of getting vaccinated, whereas response cost decreases this likelihood. Consequently, the coping appraisal results from the weighing between response-efficacy, self-efficacy, and response cost (Prentice-Dunn & Rogers, 1986).

On the other hand, the threat appraisal explains a decrease or increase of a maladaptive response towards a possible corona infection, which could be the act of refusing to get vaccinated. The constructs of vulnerability, severity, intrinsic factors, and extrinsic factors build up the threat appraisal of the model. Perceived vulnerability towards and perceived severity of the coronavirus are decreasing the likelihood to refuse vaccination. Whereas intrinsic factors and extrinsic factors are rather increasing the likelihood of refusal. Intrinsic factors are, for instance, the bodily pleasure that is experienced when refusing the

vaccination. Extrinsic factors are the perceived social approval of acting out the vaccination refusal. Consequently, the threat appraisal results from the weighing between vulnerability, severity, intrinsic-, and extrinsic factors (Prentice-Dunn & Rogers, 1986).

Lastly, the threat appraisal and the coping appraisal lead to the intention of whether to get vaccinated or not, which in turn leads to the protection behaviour, which would be to either get an actual corona vaccination or not (Prentice-Dunn & Rogers, 1986). In this paper, intrinsic factors were replaced by perceived benefits of the corona vaccination, and extrinsic factors were renamed into social norm. These concepts fitted the framework of vaccination behaviour to a greater extent.

Most studies that concentrated on the PMT regarding vaccinations focused on vaccination intention rather than on vaccination attitudes. Specifically, a study that investigated the association between the PMT and hepatitis b vaccination intention found that severity and self-efficacy are significantly positively, and response cost is significantly negatively related to vaccination intention (Liu et al., 2020). Other studies that aimed to investigate the predictiveness of some PMT factors on seasonal influenza vaccination intention showed that vulnerability, severity, benefits of vaccination, response-efficacy, self-efficacy, and response cost were significant predictors of vaccination intention (Weinstein et al., 2007; Ernsting et al., 2011; Ling et al., 2019). As corona vaccination attitude has been linked with the intention of getting vaccinated against corona (Chu & Liu, 2021; Paul et al., 2021), it appears to be of valuable contribution to examine the impact of the factors of the PMT on hesitant corona vaccination attitudes as well.

Gender and Health Condition

Besides the factors of the PMT, other variables could affect vaccine hesitancy in people as well. Research identified gender differences in attitudes considering the Human Papillomavirus (HP) vaccination. Women tend to have a more positive attitude towards the HP vaccination than men (Bynum et al., 2011; Reimer et al., 2013). In contrast, other studies that investigated vaccine hesitancy characteristics in vaccines in general (Ren et al., 2018) and corona vaccines (Schwarzinger et al., 2021) found that women tend to show higher hesitancy towards vaccines compared to men (Ren et al., 2018; Schwarzinger et al., 2021). Consequently, gender appears to play a role in vaccination attitude, and research found inconsistent results. Thus, more research on this topic is needed.

Moreover, a study concerning corona vaccination hesitancy in a French working-age population investigated whether there are differences in vaccine hesitancy regarding health

conditions. They found that people without specified chronic conditions were more vaccine-hesitant than people with a report of specified chronic conditions (Schwarzinger et al., 2021). It might be assumed that people in better health conditions would have a more negative attitude towards a corona vaccination compared to people in poor health conditions.

Thus, investigating the relationship between corona vaccine hesitancy and the factors of the PMT and health condition could be of valuable contribution to a deeper understanding of people's hesitancy towards corona vaccines. Consequently, this knowledge could support health care providers by identifying and reducing inhibiting factors of corona vaccination uptake, thus increasing people's intention and willingness to get vaccinated against corona. Finally, this could lead to an increase in vaccination uptake of the corona vaccines and a possible decrease in the spread of the coronavirus.

Current Research and Hypotheses

This paper will focus on the extent to which the psychological factors derived from the Protection Motivation Theory and health condition predict corona vaccine hesitancy in people (see Figure 2). On this basis, the following research question is established: *'To what extent do the factors of the Protection Motivation Model and health condition explain people's attitude towards corona vaccines?'*. In addition, it will be investigated if there are gender differences in vaccine hesitancy.

To give more structure, the following hypotheses were created.

H1: There is a significant negative relationship between vulnerability and vaccine hesitancy.

H2: There is a significant negative relationship between severity and vaccine hesitancy.

H3: There is a significant negative relationship between benefits of vaccination and vaccine hesitancy.

H4: There is a significant negative relationship between social norm and vaccine hesitancy.

H5: There is a significant negative relationship between response-efficacy and vaccine hesitancy.

H6: There is a significant negative relationship between self-efficacy and vaccine hesitancy.

H7: There is a significant positive relationship between response cost and vaccine hesitancy.

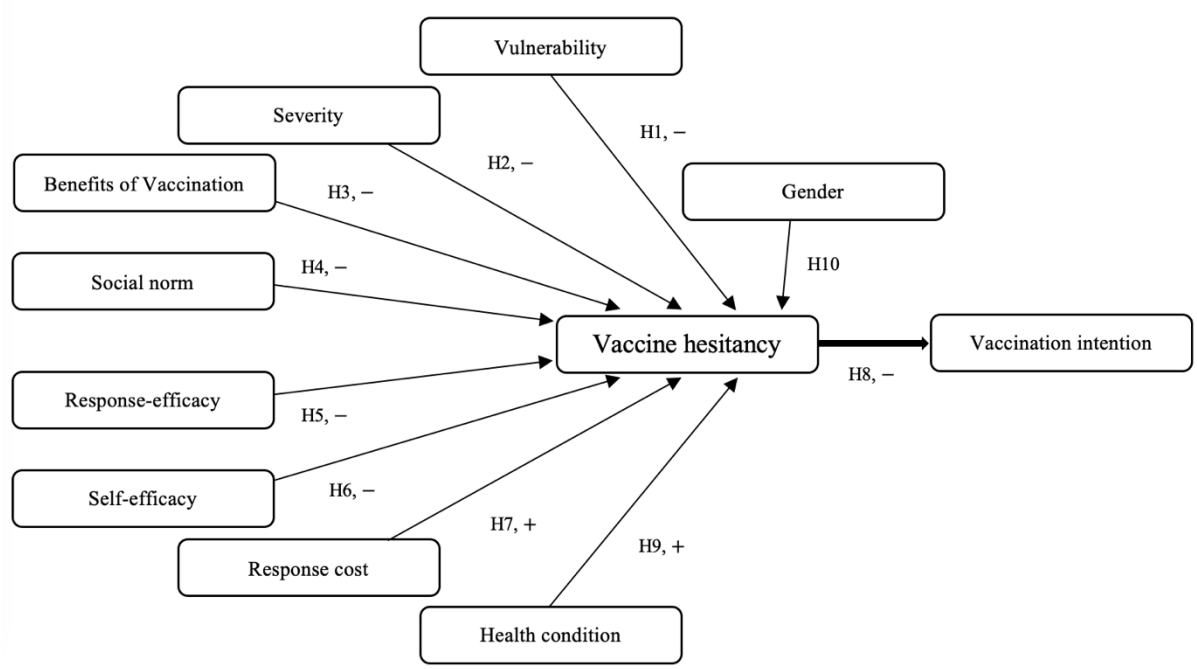
H8: There is a significant negative relationship between vaccination intention and vaccine hesitancy.

H9: There is a significant positive relationship between a good health condition and vaccine hesitancy.

H10: Women are more vaccine-hesitant than men.

Figure 2

Hypothesized Structural Equation Model, Explaining Vaccine Hesitancy



Note. Hx: Hypotheses and their number. +: Hypothesized Relationship Positive. −: Hypothesized Relationship Negative.

Method

Participants

An a priori power analysis was conducted using G*Power 3.1.9.7 (Faul et al., 2009) to estimate the required sample size needed for an exact correlation. As the aim of this study was to find either significant negative-, or significant positive, strong correlations between the factors of the PMT, including health condition, and vaccine hesitancy, a one-tailed test with a large effect size (d = .50), and an alpha of .05 was used. The result demonstrated that a total sample of 23 participants was required to achieve a power of .80.

Another G*Power analysis was done to estimate the required sample size needed for multiple linear regression analyses by using a fixed model. A medium effect size (d = .15) and an alpha of .05 were set for this. The number of predictors was assigned to the number 8 as there are eight predictors in the model: vulnerability, severity, benefits of vaccination, social norm, response-efficacy, self-efficacy, response cost, and health condition. The result showed that a total sample of 109 participants was needed to achieve a power of .80.

Convenience- and snowball sampling methods were applied to acquire the participants for the online survey. Age in this study has been reduced to a minimum age of 18 years to account for the age of majority in the European Union. Consequently, from this age onwards, people are allowed to decide whether they get a vaccination or not and if they want to participate in a study. Further, participants needed to be fluent in the English language to fully grasp what was asked of them in the survey. Thus, the inclusion criteria for this study were to be at least 18 years old and be fluent in the English language.

The total number of participants was 132, of which 28 (21%) were male-, 103 (78%) were female-, and one (1%) was non-binary/ third gender (see Table 1). The participants were between the ages of 18 and 61 (M = 23; SD = 6.9). Of all participants, 95 (72%) finished high school, 6 (4%) vocational school, 21 (16%) had a bachelor's degree, 7 (5%) a master's degree, 1 (1%) a Ph.D. or higher, and 2 (2%) indicated 'other'. Besides this, 32 (24%) participants had the Netherlands as their country of residence, 66 (50%) participants had Germany as their country of residence, and 34 (26%) respondents indicated another country to be their current residence (for more information see Table 1).

Table 1

Demographic Data of the Participants (N = 132)

	Males (*n* = 28)	Females (*n* = 103)	Non-binary/ Third gender (*n* = 1)	Total (*N* = 132)
Demographics	*n (%)*	*n (%)*	*n (%)*	*N*
Age				
18 – 25	17 (60)	93 (90)	1 (100)	111
26 - 35	7 (25)	5 (5)		12
36 - 45	2 (7)	4 (4)		6
46 - 55	1 (4)	1 (1)		2
56 - 65	1 (4)			1
Completed education				
High school graduate	12 (43)	82 (79)	1 (100)	95
Vocational school	1 (4)	5 (5)		6
Bachelor's degree	10 (35)	11 (11)		21
Master's degree	4 (14)	3 (3)		7
Doctorate		1 (1)		1
Other	1 (4)	1 (1)		2
Country of residence				
The Netherlands	10 (36)	22 (21)		32
Germany	14 (50)	52 (51)		66
Other	4 (14)	29 (28)	1 (100)	34
Austria	2 (50)	20 (70)	1 (100)	23
Finland	1 (25)			1
Italy		6 (21)		6
Romania		1 (3)		1
UK		1 (3)		1
US	1 (25)	1 (3)		2

Materials

The online survey that was used was conducted with Qualtrics software, a web-based survey tool, and was built upon seven sections. The first section gave information on the purpose of the study, the procedure, the anonymity, and the confidentiality of participants' data. Lastly, it asked about participants' consent for participation in the study (see Appendix A). Thereafter, the second section asked about participants' demographics such as age, gender, completed education, and country of residence (see Appendix B). The third, fourth, fifth, and sixth section measured this study's constructs: health condition, vulnerability, severity, benefits of vaccination, social norm, response-efficacy, self-efficacy, response cost, vaccination intention, and vaccine hesitancy. The last and seventh section debriefed the participants in more detail about the study's purpose, and they were once more asked for their consent (see Appendix C). All scales except for the scales of health condition and benefits of

vaccination included reversed items (see Appendix D for the complete list of items and the indication of reversed items).

Instruments

This study made use of ten 5-point Likert scales. Nine scales were newly established for this study, measuring vulnerability, severity, benefits of vaccination, social norm, response-efficacy, self-efficacy, response cost, vaccination intention, and health condition. The tenth scale was inspired by the Vaccination Attitude Examination Scale (VAX) (Martin & Petrie, 2017), which intends to measure vaccination attitudes. This scale was adapted accordingly to the coronavirus. All scales consisted of the answer categories 'strongly agree', 'somewhat agree', 'neither agree nor disagree', 'somewhat disagree', and 'strongly disagree' (see Appendix D for all the scales, corresponding items, and reliability measures).

Vulnerability. The vulnerability scale (α = .85) entailed five items. Example items are 'I feel that a corona infection would be harmful to me.' and 'A corona infection could get me seriously ill.'.

Severity. The severity scale (α = .66) was created out of five items, which looked like 'I think that a coronavirus infection is bad for people's health.' and 'I feel that a coronavirus infection is harmless.'.

Benefits of vaccination. The benefits of vaccination scale (α = .79) incorporated five items. Examples are 'With a corona vaccination, I would feel physically stronger.' and 'With a corona vaccination, I help to stop the spread of the virus.'.

Social norm. The social norm scale (α = .61) was built upon five items. Example items are 'The majority of people I know are willing to get vaccinated against Covid-19.' and 'The majority of people in my environment think that a corona vaccination is safe'.

Response-efficacy. The response-efficacy scale (α = .72) was composed of five items such as 'Having a corona vaccination will protect me from the coronavirus.' and 'Without a corona vaccination, I will end up in hospitalization.'.

Self-efficacy. The self-efficacy scale (α = .80) was created out of five items. Examples are 'I feel able to get vaccinated against corona.' and 'I feel able to deal with possible side-effects after a corona vaccination.'.

Response cost. The response cost scale (α = .63) entailed five items, for example, 'I feel that I have to overcome obstacles to get vaccinated against Covid-19.' and 'If I get vaccinated, I will have to deal with severe side-effects of the vaccination.'.

Vaccination intention. The vaccination intention scale (α = .96) was built upon five items. Examples are 'When I am able to get a corona vaccination, I will get one.' and 'I intend to get vaccinated against corona if it would help stop the spread of the virus.'.

Health condition. The health condition scale (α = .63) incorporated four items, which looked like 'I feel physically healthy.' and 'I can live without medical devices.'.

Vaccine hesitancy. And lastly, the vaccine hesitancy scale (α = .90) was composed of twelve items. Examples are 'Corona vaccines make a lot of money for pharmaceutical companies, but do not do much for regular people.' and 'Corona vaccines can cause unforeseen problems in people.'.

Factor Analysis of the Vaccine Hesitancy Scale

The Principal Component Analysis and the Varimax rotation results regarding the factor analysis for the vaccine hesitancy scale showed that there are four underlying factors (see Appendix E). The first factor consisted of four items reported on a 5-point Likert scale that explained around 47.5% of the variance with factor loadings from .44 to .89. The second identified factor was composed of three items that explained about 11.5% of the variance with factor loadings from .81 to .82. The third factor entailed four items that explained about 8.9% of the variance with factor loadings from .37 to .85. And lastly, the fourth factor included three items that explained around 8.5% of the variance with factor loadings from .69 to .82 (see Appendix E). The labelling of the factors was as follows. The first factor, consisting of items 9, 10, 11, and 12, was labelled 'natural exposure to virus'. The second factor, which was composed of items 3, 4, and 5, was labelled 'trust in the effectiveness of the vaccine'. The third factor was labelled 'financial gain behind vaccines', and entailed items 1, 2, 5, and 9. And lastly, the fourth factor was composed of items 6, 7, and 8 and was named 'unknown side-effects of the vaccine' (see Appendix E).

Design and Procedure

Before the data collection took place, the Ethics Committee of the University of Twente approved the study on the 9th of April 2021.

For acquiring the data, a cross-sectional quantitative questionnaire survey was used, and the time necessary for completing the survey amounted to ten minutes. The collection of IP addresses within Qualtrics was deactivated before data collection to protect participants' anonymity. Additionally, the respondents did not receive any rewards besides Psychology-, and Communication Science students at the University of Twente, which surveyed to acquire study credits for their subject of study via the platform 'SONA'. SONA is a study-

distributing service of the University of Twente for Psychology-, and Communication Science students.

By clicking on the link that was distributed online via social media platforms (e.g., Facebook, WhatsApp, Snapchat, and Instagram) and SONA, the participants could access the survey. At the beginning of the questionnaire, the participants had to give their consent after reading about a short introduction to the study, the confidentiality and anonymity of their data, and lastly, the researcher's contact information in the case of further questions. If they agreed to do so, they would continue by answering demographic questions, indicating their current health condition by answering statements about their physical and mental health, and indicating the extent of their agreement on various statements concerning a corona vaccination. Responses were forced in the demographic part, whereas to answer the rest of the survey was left for the participants' choice to achieve a higher response rate and prevent participants from leaving the survey before finishing it. In the end, a short debriefing took place in which the aim of the study was given in more detail than at the beginning. The participants were once again asked for their consent. After this, a page followed on which the contact details of the researcher, as well as of the ethical commission from the Behavioural, Management, and Social Sciences (BMS) faculty of the University of Twente, were given (see Appendix F).

Data Analysis

The software package IBM SPSS Statistics Version 26 was used for all analyses in this study. At first, all data from participants that indicated withdrawal from the study and participants that solely filled out the demographic part of the questionnaire were removed from the dataset. Next to this, descriptive characteristics were explored to get an overview of the statistical distributions of each item. Thereafter, all reversed items were recoded, and then reliability analyses were done to check how reliable the scales are. As a general reference point that would indicate a sufficient Cronbach's alpha value, the value of .70 could be found (Field, 2009). After, new variables were computed for all ten scales that represented the average score of each construct.

Then, Kolmogorov-Smirnov-, and Shapiro-Wilk tests were conducted for all scales for the normality assumption. The test results showed that the data for all scales were not normally distributed as all scales showed significant p-values on both tests. Also, the corresponding histograms of the scales showed no normality.

Moreover, a factor analysis was done for investigating underlying factors of the vaccination hesitancy scale and for checking which items of this scale measure which factor. This was done by conducting a Principal Component Analysis as an extraction method, and after, a Varimax rotation was done as a rotation method.

Thereafter, one-sided Pearson's correlational analyses were conducted to check which and to what extent factors significantly correlate with each other[1]. For the factors of response cost and health condition, significant positive associations with vaccine hesitancy were expected. Whereas for the factors of vulnerability, severity, benefits of vaccination, social norm, response-efficacy, self-efficacy, and vaccination intention, significant negative correlations with vaccine hesitancy were expected. A correlation that indicates a value below .30 would be considered weak. In contrast, a correlation coefficient between .30 and .49 would indicate a moderate correlation, and lastly, a coefficient of .50 or higher would be considered as a strong correlation (Field, 2009). Additionally, a p-value of 0.05 or less was chosen as an indicator for a significant correlation.

Furthermore, three multiple linear regression analyses were done. First, it was investigated to what extent the independent variables predict vaccine hesitancy. Second, as an exploratory analysis, this was repeated with vaccination intention as the dependent variable to check for differences in the predictive power of the model and in individual determinants for vaccine hesitancy and vaccination intention. Third, another exploratory regression analysis for vaccination intention as the dependent variable was conducted by including vaccine hesitancy into the model. This was done to investigate the extent to which vaccine hesitancy predicts vaccination intention in combination with the other determinants.

Lastly, the means of the vaccine hesitancy scale for men and women were compared to check if they are statistically different from each other. For this, a Levene's test for equality of variances was done to assess whether homogeneity of variances could be assumed. Thereafter, an independent t-test was done.

Results

The dependent variable of this study, i.e., vaccine hesitancy, had a mean score of 2.6 (*SD* = 0.8) (see Table 2). For the vaccination hesitancy scale, this mean indicates that people overall have a rather neutral to accepting attitude towards the corona vaccination, as for all

[1] Both Spearman's and Pearson's correlation analyses were done. As the results showed that the correlations of both analyses were similar, Pearson's correlation analysis was used to ensure consistent application of parametric tests in this study.

scales, a score of 1 indicates a low score, and a score of 5 indicates a high score. Vulnerability had a mean of 3.6, which indicates that people feel somewhat vulnerable towards a corona infection. The mean score of severity was 4.0. This score assumes that participants perceive the coronavirus as severe. For the benefits of vaccination scale, the sample had a mean of 3.6, which indicates that people rather think that a corona vaccination would be able to reduce or diminish possible consequences of an infection. Social norm had a mean of 3.6, which indicates that people perceive their environment as relatively neutral to acceptant towards corona vaccines. The mean score of response-efficacy was 3.6. This score assumes that participants rather think that a corona vaccination would protect them from dealing with possible consequences of an infection. For the self-efficacy scale, the sample had a mean of 4.2, which demonstrates that people feel able to get vaccinated against corona. Response cost had a mean of 2.4, which indicates that people rather think that getting a corona vaccination would not cause them any inconveniences. The mean score of vaccination intention was 4.4. This score assumes that participants intend to get vaccinated against corona. And lastly, for the health condition scale, the sample had a mean score of 4.3, which indicates that people overall perceive themselves as healthy.

Correlation Between the Variables

The results of the one-sided Pearson's correlational analyses showed that there was a significant negative relationship between vaccine hesitancy and the constructs of vulnerability (r (130) = -.32, $p < .01$), severity (r (131) = -.49, $p < .01$), benefits of vaccination (r (131) = -.66, $p < .01$), social norm (r (131) = -.52, $p < .01$), response-efficacy (r (131) = -.69, $p < .01$), self-efficacy (r (130) = -.57, $p < .01$), and vaccination intention (r (129) = -.76, $p < .01$). This means that a person scoring high in these constructs also scored low in vaccine hesitancy and vice versa. Consequently, *Hypothesis 1 to 6* and *Hypothesis 8* can be accepted (see Table 4).

As vaccine hesitancy correlated non-significantly and negatively with health condition (r (131) = -.14, $p > .05$), *Hypothesis 9* needs to be rejected. Response cost and vaccine hesitancy showed a significant positive correlation, and thus, *Hypothesis 7* can be accepted (see Table 4). This implies that if a person scores high in response cost, they would most probably also score high in vaccine hesitancy. Regarding the correlations with vaccine hesitancy, the strongest significant correlation of the model was between vaccination intention and vaccine hesitancy. In contrast, the lowest significant correlation was identified between vulnerability and vaccine hesitancy. It can also be seen that all factors that correlated

negatively with vaccine hesitancy correlated positively with vaccination intention and vice versa (see Table 2, also for the remaining correlations).

Table 2

Means, Standard deviations, and Pearson Correlations between Determinants and Vaccine Hesitancy (N = approximately 132)

Variables	Mean	SD	Correlations									
			1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Vaccine hesitancy	2.6	0.8	1.00									
2. Vulnerability	3.6	0.9	-.32**	1.00								
3. Severity	4.0	0.6	-.49**	.62**	1.00							
4. Benefits of vaccination	3.6	0.9	-.66**	.63**	.58**	1.00						
5. Social norm	3.6	0.7	-.52**	.20*	.39**	.47**	1.00					
6. Response-efficacy	3.6	0.8	-.69**	.53**	.61**	.75**	.41**	1.00				
7. Self-efficacy	4.2	0.8	-57**	.29**	.45**	.58**	.37**	.62**	1.00			
8. Response cost	2.4	0.7	.54**	-.11	-.28**	-.37**	-.44**	-.45**	-.62**	1.00		
9. Vaccination intention	4.4	0.9	-.76**	.34**	.48**	.69**	.52**	.67**	.64**	-.49**	1.00	
10. Health condition	4.3	0.7	-.14	.01	.05	-.03	.11	.04	.18*	-.10	.18*	1.00

Note. ** $p < .01$, * $p < .05$ (one-tailed).

Regression Analyses

Moreover, the results of the three multiple linear regression analyses that were carried out to investigate the predictive power of the model for vaccine hesitancy and vaccination intention showed the following. The model explained 61.8% of the variance in vaccine hesitancy, and significantly predicted vaccine hesitancy, $F(8, 120) = 24.24$, $p < .01$. While response-efficacy ($\beta = -.31$, $p < .01$), benefits of vaccination ($\beta = -.35$, $p < .01$), and response

cost (β = .21, p = .01) contributed significantly to the model, the remaining variables, i.e., vulnerability (β = .15, p = .07), severity (β = -.08, p = .35), self-efficacy (β < -.01, p = .99), and social norm (β = -.12, p = .10) did not (see Table 3). Consequently, the *research question* of this study can be answered by saying that the model was able to predict 61.8% of the variance in vaccine hesitancy. Specifically, the constructs of response-efficacy, benefits of vaccination, and response cost were significant predictors of vaccine hesitancy.

The result of the first exploratory analysis for vaccination intention showed that the model explained 63.4% of the variance in vaccination intention, and that the model significantly predicted vaccination intention as well, F (8, 119) = 25.75, p < .01. While benefits of vaccination (β = .40, p < .01), response-efficacy (β = .23, p = .02), self-efficacy (β = .19, p = .03), health condition (β = .13, p = .03), and social norm (β = .15, p = .04) contributed significantly to the model, the remaining variables, i.e., vulnerability (β = -.15, p = .07), severity (β = .04, p = .62), and response cost (β = -.05, p = .55) did not (see Table 3).

When including vaccine hesitancy into the model, the model explained 68.9% of the variance in vaccination intention. The model including vaccine hesitancy as a predictor also predicted vaccination intention significantly, F (9, 118) = 29.01, p < .01. Vaccine hesitancy (β = -.38, p < .01), benefits of vaccination (β = .27, p < .01), and self-efficacy (β = .19, p = .02) contributed significantly to the model. Severity (β = .01, p = .89), response cost (β = .03, p = .65), response-efficacy (β = .11, p = .23), vulnerability (β = -.09, p = .23), social norm (β = .10, p = .12), and health condition (β = .09, p = .11) did not (see Table 3).

Table 3

Multiple Linear Regression Analyses Results for the Effect of the Model on Vaccine Hesitancy and Vaccination Intention (N = approximately 132)

Predictors (Constant)	Vaccine hesitancy			Vaccination intention			Vaccination intention		
	β	*t*	*p*	*β*	*t*	*p*	*β*	*t*	*p*
Vaccine hesitancy							-.38**	-4.59	< .01
Vulnerability	.15	1.85	.07	-.15	-1.85	.07	-.09	-1.21	.23
Severity	-.08	-.95	.35	.04	.50	.62	.01	.14	.89
Benefits of vaccination	-.35**	-3.34	< .01	.40**	3.89	< .01	.27**	2.69	< .01
Social norm	-.12	-1.64	.10	.15*	2.09	.04	.10	1.57	.12
Response-efficacy	-.31**	-3.24	< .01	.23*	2.43	.02	.11	1.22	.23
Self-efficacy	< -.01	-.01	.99	.19*	2.25	.03	.19*	2.42	.02
Response cost	.21**	2.71	.01	-.05	-.61	.55	.03	.46	.65
Health condition	-.10	-1.72	.09	.13*	2.18	.03	.09	1.61	.11

Note. Dependent variables: Vaccine hesitancy and vaccination intention. R^2: .62 (vaccine hesitancy). R^2: .63 (vaccination intention). R^2: .69 (vaccination intention, including vaccine hesitancy as predictor). ** $p < .01$, * $p < .05$.

Gender Difference in Vaccine Hesitancy

Further, after conducting a Levene's test for equality of variances, homogeneity of variances could be shown. Consequently, an independent t-test was done to check if there is a statistically significant difference between women and men regarding their average score on vaccine hesitancy. First, the mean score for women was 2.6 (*SD* = .8), and the mean score for men was also 2.6 (*SD* = .8). The results of the independent t-test confirmed then that the two populations did not statistically differ from each other in vaccine hesitancy, $t(128) = .42$, p = .68). Consequently, *Hypothesis 10* needs to be rejected (see Table 4).

Table 4

Summary of Accepted and Rejected Hypotheses

Hypotheses	Status
H1: There is a significant negative relationship between vulnerability and vaccine hesitancy.	Accepted
H2: There is a significant negative relationship between severity and vaccine hesitancy.	Accepted
H3: There is a significant negative relationship between benefits of vaccination and vaccine hesitancy.	Accepted
H4: There is a significant negative relationship between social norm and vaccine hesitancy.	Accepted
H5: There is a significant negative relationship between response-efficacy and vaccine hesitancy.	Accepted
H6: There is a significant negative relationship between self-efficacy and vaccine hesitancy.	Accepted
H7: There is a significant positive relationship between response cost and vaccine hesitancy.	Accepted
H8: There is a significant negative relationship between vaccination intention and vaccine hesitancy.	Accepted
H9: There is a significant positive relationship between a good health condition and vaccine hesitancy.	Rejected
H10: Women are more vaccine-hesitant than men.	Rejected

Discussion

Summary of the Results

The results of the Pearson's correlation analysis revealed that vaccine hesitancy is significantly negatively related to vulnerability, severity, benefits of vaccination, social norm, response-efficacy, self-efficacy, vaccination intention, and health condition. Thus, Hypothesis 1 to 6 and Hypothesis 8 can be accepted, and Hypothesis 9 needed to be rejected. We also found that vaccine hesitancy was significantly positively correlated with response cost. Hence, Hypothesis 7 can be accepted. As we could not identify any gender differences in vaccine hesitancy, Hypothesis 10 needed to be rejected.

By looking at the regression analyses that were done, the research question can be answered by saying that the model of this study was able to explain 61.8% of the variance in vaccine hesitancy. The strongest predictors of the model were benefits of vaccination, response-efficacy, and response cost for vaccine hesitancy. Whereas vulnerability, severity, social norm, self-efficacy, and health condition were no significant predictors in combination with the other determinants.

The first exploratory analysis for vaccination intention showed that the model was able to explain 63.4% of the variance in vaccination intention. Whereby, the strongest predictors for vaccination intention were benefits of vaccination, response-efficacy, self-efficacy, health condition, and social norm. In contrast, the constructs of vulnerability, severity, and response cost could not be identified as significant predictors in combination with the other determinants.

When including vaccine hesitancy into the model, the results of the second exploratory analysis showed that the predictive power increased to 68.9% for vaccination intention. Then, the strongest predictors were vaccine hesitancy, benefits of vaccination, and self-efficacy in combination with the other predictors. The remaining predictors did not significantly contribute to the model.

Overall, six out of nine variables of the model showed a significantly high correlation with vaccine hesitancy. Whereby the correlation between vaccination intention and vaccine hesitancy was the strongest significant one, and between vulnerability and vaccine hesitancy the lowest significant one. The relationship between health condition and vaccine hesitancy was the only non-significant one. These results might be empowered by saying that this study could achieve a sufficient sample size and that six out of ten scales had good reliability, i.e., higher than .70. As some scales showed good reliability and as the model of this study including vaccine hesitancy showed to have a great predictability for vaccination intention, the scales and model of this study might be further used for future research in the context of corona vaccines.

Embedding of the Findings into Existing Literature

Considering vaccine hesitancy, we found that the model was able to explain 61.8% of the variance in corona vaccine hesitancy. Other studies that investigated the predictability of constructs similar to those used in our study on vaccine hesitancy could not be found. Also, when considering the correlation analysis of this study, there is not yet enough literature concerning the relationship between vaccination attitude and psychological factors similar to those of the PMT available. What could be found, Timmermans et al. (2008) inspected the effect of various factors on parents' attitudes towards Meningococcal C vaccines and found that the higher the perceived vulnerability of their child towards the bacteria, the higher the accepting attitude towards the vaccines for it (Timmermans et al., 2008). In this aspect, the correlation between vulnerability and vaccine hesitancy shows consistency within the literature. Next to this, Paul et al. (2021), as well as Chu and Liu (2021), found that a hesitant corona vaccination attitude was negatively correlated with the intention to vaccinate. Similarly, a significant strong negative correlation could be found in this study between these two variables. Although more research concerning vaccination attitudes is needed, we hope that the results that were found might give a first insight into vaccination attitudes.

When considering vaccination intention, we found that the model was able to explain 63.4% of the variance of corona vaccination intention in people. Ling et al. (2019) found a

similar result. Their study investigated the usefulness of the PMT for predicting vaccination intention for seasonal influenza, and their model had a predictive power of 62% (Ling et al., 2019). Next to this, vulnerability, severity, response-efficacy, and self-efficacy were found to be the main determinants of vaccination intention. However, response cost was found to not uniquely account for the variance in vaccination intention (Ling et al., 2019). These findings resemble only partially the results of our study as vulnerability and severity were not identified as significant predictors for vaccination intention. Reasons for this difference could not be found. Therefore, it needs to be assumed that there is a difference in this aspect regarding influenza and corona virus.

Furthermore, considering the correlations that were found between the various variables and vaccination intention, Wang et al. (2021) investigated the correlation between the factors of the PMT and corona vaccination motivation and found a positive correlation between corona vaccination motivation and the variables of vulnerability, severity, response-efficacy, and self-efficacy. These variables also correlated positively with vaccination intention in our study. According to the Protection Motivation Theory (Prentice-Dunn & Rogers, 1986), protection motivation and intention are treated similarly. Thus, it appears as our findings regarding these factors are consistent with existing literature. Similarly, Ling et al. (2019), who investigated which factors of the PMT could predict seasonal influenza vaccination intention found that vulnerability, severity, response-efficacy, and self-efficacy showed a positive correlation with vaccination intention.

However, contrary to the present study's findings, the study of Wang et al. (2021) found a non-significant positive relationship between corona vaccination motivation and response cost. In our study, a significant negative relationship was found between vaccination intention and response cost. Importantly, Wang et al. (2021) did not find a significant association, whereas our study did. Wang et al. (2021) did not suggest any explanations in their study. However, Ling et al. (2019) found similar results to our study: response cost showed a significant negative correlation with influenza vaccination intention.

The variable of health condition was found to correlate non-significantly and negatively with vaccine hesitancy in this sample. However, this is not in line with previous research, as Schwarzinger et al. (2021) illustrated in their study that people in good health conditions show greater vaccine hesitancy. Nonetheless, it should be noted that the study of Schwarzinger et al. (2021) focused on specified chronic conditions such as hypertension. Hence, the variable of health condition in our study may not have been specific enough to establish an association between these outcomes as it focused on physical and mental health

together. This could also explain why the finding of our study is non-significant. Thus, this finding should be considered with caution.

Considering the finding of the present study that there is no significant gender difference in vaccine hesitancy, studies by Bynum et al. (2011), Reimer et al. (2013), Ren et al. (2018), and Schwarzinger et al. (2021) had different results. To be concrete, gender differences in vaccination attitude towards a Human Papillomavirus (HP) vaccination (Bynum et al., 2011; Reimer et al., 2013), vaccines in general (Ren et al., 2018), and corona vaccines (Schwarzinger et al., 2021) were found so far, i.e., women showed higher levels of vaccine acceptance for HP vaccines than men but higher vaccine hesitancy than men for general and corona vaccines. A reason for our finding could be that the sample sizes of women and men in this study differed to a great extent, i.e., the sample of women was about four times larger than that of men. According to Altman (1999), differences in sample sizes could affect the detection of differences between groups. This might have been the case in our study, as no significant results between women and men were found.

Limitations and Recommendations

For the limitations of this study, it can be argued that although the scales that were used in this study showed non-normality, parametric tests were used to analyse the obtained data. As mentioned earlier, Spearman's and Pearson's correlation analyses were conducted, and the results showed that the correlations of both analyses were similar. For consistent use of parametric tests, Pearson's correlation analysis was used for this study. This should be kept in mind when interpreting the results.

Also, considering the distribution of the variables gender and age, it needs to be noted that the majority of the sample was of female gender and young age. Consequently, the sample of this study was not equally distributed. Thus, the results may not be able to represent the population, and hence, the findings of this study need to be interpreted with caution within the population. The reason for this distribution could have been the sampling method of this study, i.e., convenience-, and snowball sampling, and the social environment of the research team that consisted of mostly young female participants. Therefore, it is recommended that future research use a random sampling method to account for an equal distribution of gender and age.

A further limitation might be that the health condition scale asked for the physical and mental health of the participant. This could have influenced the analysed relationship between health condition and vaccine hesitancy as this scale was not exclusively specified on

health, such as the study of Schwarzinger et al. (2021). They focused on specific chronic conditions, which can be considered as physical health. This means there might be a difference in significance and strength of the relationship between health condition and vaccine hesitancy if health condition would focus on either physical or mental health. Thus, it is advised for future research to focus on specific health conditions such as either physical or mental health.

Furthermore, future research could investigate whether the variables that correlated significantly with vaccine hesitancy and vaccination intention are interacting with each other, and thus, might affect their relationship with the dependent variables. Concretely, the variables of benefits of vaccination and response-efficacy might interact with each other as they are not only strongly correlated with vaccine hesitancy but also with each other. Similarly, the variables of benefits of vaccination, response-efficacy, and self-efficacy might affect their relationship with vaccination intention as they are also strongly correlated with each other. Besides, the interaction of benefits of vaccination and response-efficacy might further affect the relationship between vaccine hesitancy and vaccination intention as both factors correlate significantly with vaccine hesitancy and vaccination intention.

And lastly, as the exploratory regression analyses showed, when vaccine hesitancy was included in the model, response-efficacy, health condition, and social norm did not significantly predict vaccination intention anymore. It is therefore assumed that vaccine hesitancy has an effect on the relationship between response-efficacy, health condition, and social norm and vaccination intention. It is advised that future research should investigate this in more detail.

Implications

As the model's predictive power was similar for both vaccine hesitancy and vaccination intention, it might be assumed that the factors of the PMT can be applied to vaccination attitude besides, as suggested by the model, vaccination intention. Additionally, as vaccine hesitancy was a significant predictor of vaccination intention, it is suggested to include attitude into the PMT when applying this model in the context of corona vaccinations. This appears to be in line with the Theory of Planned Behaviour, according to which attitude is treated as one antecedent of intention as well (Ajzen, 1991).

Overall, health care providers could apply the findings of this study when planning on effective distribution and advertisement of corona vaccines, as well as when planning on creating successful vaccination promoting interventions. By this, our findings could help to

establish successful risk communication methods. For instance, health care providers could ensure that within those interventions, people are informed about the efficacy and benefits that corona vaccines have. Also, health care providers should pay some attention to informing people about possible side effects and give instructions on how and where to get vaccinated. The aforementioned would account for a clarification regarding the factors of response-efficacy, benefits of vaccination, and response cost of the corona vaccines, which were found to be the main predictors for vaccine hesitancy in this study. Thus, when increasing people's knowledge about these factors, they might get more vaccine acceptant. Consequently, these people might be more willing to get themselves vaccinated. Thereby, the virus might be combated by decreasing the further spread of the virus.

Conclusion

This study aimed to find out to what extent the factors of the PMT and health condition can determine corona vaccine hesitancy in people. Concretely, the results showed that response-efficacy, benefits of vaccination, and response cost were the main determinants of vaccine hesitancy. For vaccination intention, the constructs of benefits of vaccination, response-efficacy, self-efficacy, health condition, and social norm were found to be the main predictors. When including vaccine hesitancy into the model, vaccine hesitancy, benefits of vaccination, and self-efficacy were the strongest predictors for vaccination intention. Also, the model, with and without vaccine hesitancy, used in this study was able to predict vaccine hesitancy and vaccination intention to a great extent.

All in all, this study can contribute its part to combating the coronavirus by providing the health care sector with insights into people's behaviour, which could now be used, for instance, to create successful vaccination promoting interventions, and by this, to potentially decrease the further spread of the virus.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-t

Altman, D. G. (1999). *Practical statistics for medical research*. Boca Raton, FL: Chapman & Hall/CRC.

Bicen, H., & Cavus, N. (2011). Social network sites usage habits of undergraduate students: Case study of Facebook. *Procedia - Social and Behavioral Sciences, 28*, 943-947. https://doi.org/10.1016/j.sbspro.2011.11.174

Bynum, S., Brandt, H., Friedman, D., Annang, L., & Tanner, A. (2011). Knowledge, Beliefs, and Behaviors: Examining Human Papillomavirus-Related Gender Differences Among African American College Students. *Journal of American College Health, 59*(4), 296-302. https://doi.org/10.1080/07448481.2010.503725

Callaway, E. (2020, April 28). The race for coronavirus vaccines: a graphical guide. https://www.nature.com/articles/d41586-020-01221-y

Centers for Disease Control and Prevention. (2021, February 11). COVID-19 Vaccination Intent, Perceptions, and Reasons for Not Vaccinating Among Groups Prioritized for Early Vaccination - United States, September and December 2020. https://www.cdc.gov/mmwr/volumes/70/wr/mm7006e3.htm

Centers for Disease Control and Prevention. (2021, June 07). Similarities and Differences between Flu and COVID-19. https://www.cdc.gov/flu/symptoms/flu-vs-covid19.htm

Centraal Bureau voor de Statistiek. (2021, May 26). 7 op de 10 mensen bereid tot vaccinatie tegen corona. https://www.cbs.nl/nl-nl/nieuws/2021/21/7-op-de-10-mensen-bereid-tot-vaccinatie-tegen-corona

Chu, H., & Liu, S. (2021). Integrating health behavior theories to predict American's intention to receive a COVID-19 vaccine. *Patient Education and Counseling, 104*(8), 1878-1886. https://doi.org/10.1016/j.pec.2021.02.031

Dashraath, P., Wong, J. L., Lim, M. X., Lim, L. M., Li, S., Biswas, A., Choolani, M., Mattar, C., Su, L. L. (2020). Coronavirus disease 2019 (COVID-19) pandemic and pregnancy. *American Journal of Obstetrics and Gynecology, 222*(6), 521-531. https://doi.org/10.1016/j.ajog.2020.03.021

Ernsting, A., Lippke, S., Schwarzer, R., & Schneider, M. (2011). Who Participates in Seasonal Influenza Vaccination? Past Behavior Moderates the Prediction of

Adherence. *Advances in Preventive Medicine, 2011*, 1-6. https://doi.org/10.4061/2011/148934

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149–1160. https://doi.org/10.3758/brm.41.4.1149

Fazio, R. H., & Williams, C. J. (1986). Attitude accessibility as a moderator of the attitude–perception and attitude–behavior relations: An investigation of the 1984 presidential election. *Journal of Personality and Social Psychology, 51*(3), 505-514. https://doi.org/10.1037/0022-3514.51.3.505

Field, A. P. (2009). *Discovering Statistics using IBM SPSS Statistics: and sex and drugs and rock n roll*. London: SAGE Publications Ltd.

Happer, C., & Philo, G. (2013). The Role of the Media in the Construction of Public Belief and Social Change. *Journal of Social and Political Psychology, 1*(1), 321-336. https://doi.org/10.5964/jspp.v1i1.96

Henley, J. (2021, February 04). A quarter of people in France, Germany and the US may refuse Covid vaccine. https://www.theguardian.com/world/2021/feb/04/covid-vaccine-refuse-france-germany-us-quarter

Khan, N., Fahad, S., Faisal, S., & Naushad, M. (2020). Quarantine Role in the Control of Corona Virus in the World and Its Impact on the World Economy. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3556940

Kraus, S. J. (1995). Attitudes and the Prediction of Behavior: A Meta-Analysis of the Empirical Literature. *Personality and Social Psychology Bulletin, 21*(1), 58-75. https://doi.org/10.1177/0146167295211007

Lazarus, J. V., Ratzan, S. C., Palayew, A., Gostin, L. O., Larson, H. J., Rabin, K., Kimball, S., El-Mohandes, A. (2020). A global survey of potential acceptance of a COVID-19 vaccine. *Nature Medicine, 27*(2), 225-228. https://doi.org/10.1038/s41591-020-1124-9

Leippe, M. R., & Elkin, R. A. (1987). When motives clash: Issue involvement and response involvement as determinants of persuasion. *Journal of Personality and Social Psychology, 52*(2), 269-278. https://doi.org/10.1037/0022-3514.52.2.269

Ling, M., Kothe, E. J., & Mullan, B. A. (2019). Predicting intention to receive a seasonal influenza vaccination using Protection Motivation Theory. *Social Science & Medicine, 233*, 87-92. https://doi.org/10.1016/j.socscimed.2019.06.002

Liu, C., Nicholas, S., & Wang, J. (2020). The association between protection motivation and hepatitis b vaccination intention among migrant workers in Tianjin, China: A cross-sectional study. *BMC Public Health, 20*(1). https://doi.org/10.1186/s12889-020-09292-2

Martin, L. R., & Petrie, K. J. (2017). Understanding the Dimensions of Anti-Vaccination Attitudes: The Vaccination Attitudes Examination (VAX) Scale. *Annals of Behavioral Medicine, 51*(5), 652-660. https://doi.org/10.1007/s12160-017-9888-y

Muralikrishna, I. V., & Manickam, V. (2017). Environmental Risk Assessment. *Environmental Management,* 135-152. https://doi.org/10.1016/b978-0-12-811989-1.00008-7

Osatuyi, B. (2013). Information sharing on social media sites. *Computers in Human Behavior, 29*(6), 2622-2631. https://doi.org/10.1016/j.chb.2013.07.001

Paul, E., Steptoe, A., & Fancourt, D. (2021). Attitudes towards vaccines and intention to vaccinate against COVID-19: Implications for public health communications. *The Lancet Regional Health - Europe, 1*, 100012. https://doi.org/10.1016/j.lanepe.2020.100012

Prentice-Dunn, S., & Rogers, R. W. (1986). Protection Motivation Theory and preventive health: Beyond the Health Belief Model. *Health Education Research, 1*(3), 153-161. https://doi.org/10.1093/her/1.3.153

Radtke, V. V. (2021, May 19). Impfbereitschaft gegen das Coronavirus in Deutschland 2021. https://de.statista.com/statistik/daten/studie/1147628/umfrage/umfrage-zur-corona-impfbereitschaft-in-deutschland/

Reimer, R. A., Schommer, J. A., Houlihan, A. E., & Gerrard, M. (2013). Ethnic and Gender Differences in HPV Knowledge, Awareness, and Vaccine Acceptability Among White and Hispanic Men and Women. *Journal of Community Health, 39*(2), 274-284. https://doi.org/10.1007/s10900-013-9773-y

Ren, J., Wagner, A. L., Zheng, A., Sun, X., Boulton, M. L., Huang, Z., & Zikmund-Fisher, B. J. (2018). The demographics of vaccine hesitancy in Shanghai, China. *Plos One, 13*(12). https://doi.org/10.1371/journal.pone.0209117

Rogers, R. W. (1975). A Protection Motivation Theory of Fear Appeals and Attitude Change1. *The Journal of Psychology, 91*(1), 93-114. https://doi.org/10.1080/00223980.1975.9915803

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation [PDF File]. https://www.researchgate.net/publication/229068371_Cognitive_and_physiological_processes_in_fear_appeals_and_attitude_change_A_revised_theory_of_protection_motivation

Schwarzinger, M., Watson, V., Arwidson, P., Alla, F., & Luchini, S. (2021). COVID-19 vaccine hesitancy in a representative working-age population in France: A survey experiment based on vaccine characteristics. *The Lancet Public Health*. https://doi.org/10.1016/s2468-2667(21)00012-8

Timmermans, D. R., Henneman, L., Hirasing, R. A., & Wal, G. V. (2008). Parents perceived vulnerability and perceived control in preventing Meningococcal C infection: A large-scale interview study about vaccination. *BMC Public Health, 8*(1). https://doi.org/10.1186/1471-2458-8-45

Torales, J., O'Higgins, M., Castaldelli-Maia, J. M., & Ventriglio, A. (2020). The outbreak of COVID-19 coronavirus and its impact on global mental health. *International Journal of Social Psychiatry, 66*(4), 317-320. https://doi.org/10.1177/0020764020915212

Wang, P., Ahorsu, D. K., Lin, C., Chen, I., Yen, C., Kuo, Y., Griffiths, M. D., Pakpour, A. H. (2021). Motivation to Have COVID-19 Vaccination Explained Using an Extended Protection Motivation Theory among University Students in China: The Role of Information Sources. *Vaccines, 9*(4), 380. https://doi.org/10.3390/vaccines9040380

Weinstein, N. D., Kwitel, A., Mccaul, K. D., Magnan, R. E., Gerrard, M., & Gibbons, F. X. (2007). Risk perceptions: Assessment and relationship to influenza vaccination. *Health Psychology, 26*(2), 146-151. https://doi.org/10.1037/0278-6133.26.2.146

WHO. (n.d.). https://covid19.who.int/

Williams, V. (2020, March 30). How the virus that causes COVID-19 differs from other coronaviruses. https://newsnetwork.mayoclinic.org/discussion/how-the-virus-that-causes-covid-19-differs-from-other-coronaviruses/

Wilson, S. L., & Wiysonge, C. (2020). Social media and vaccine hesitancy. *BMJ Global Health, 5*(10). https://doi.org/10.1136/bmjgh-2020-004206

Yaqub, O., Castle-Clarke, S., Sevdalis, N., & Chataway, J. (2014). Attitudes to vaccination: A critical review. *Social Science & Medicine, 112*, 1-11. https://doi.org/10.1016/j.socscimed.2014.04.018

Appendices

Appendix A

Informed Consent

Thank you for considering participation in this study!

Goal

The goal of this study is to investigate what factors determine people's attitudes and intentions towards Covid-19 vaccines.

Procedure

You will be asked some demographic questions and questions about your current health condition. After, your opinion concerning a Corona vaccination will be asked. There are no right or wrong answers. Just choose the one that you believe fits you the best. You can stop the study at any time without further explanation. The whole procedure will take approximately 10 minutes. The minimum age for this study is 18 years and a proficiency level of the English language is required. If you have any questions, do not hesitate to ask (s.paczulla@student.utwente.nl).

Data Collection

Your participation has no risks or consequences for you. However, as with any online activity, the possibility of a data breach is always given. The collected data will be anonymized, which means it is not possible to trace the answers back to you. The anonymous data will only be used to analyse the relationship between the answers given. They will not be shared with anyone outside the research team. Your data is anonymous, and third parties will not use your data.

Consent

'By pressing "Continue", I declare that I have been informed about the content and goal of this study. Also, I declare that my current age is 18 years or older and that I am fluent in English. My participation is entirely voluntary. I reserve the right to withdraw this consent without the need to give any reason, and I am aware that I may withdraw from the questionnaire at any time. The answers I provide will be anonymized and do not have any

consequences for me. If I request any further information about the research, now or in the future, I may contact the researcher through an email (s.paczulla@student.utwente.nl).'

Appendix B

Q1. What is your gender?

- Male
- Female
- Non-binary/ third gender
- Prefer not to say

Q2. How old are you?

‘Blank space’

Q3. What is your highest level of completed education?

- Less than high school
- High school graduate
- Vocational school/ Berufsschule
- Bachelor’s degree
- Master’s degree
- Doctorate
- Other

Q4. What is your country of residence?

- The Netherlands
- Germany
- Other, namely

‘Blank space’

Appendix C

Important Information

At the beginning of this survey, we told you that this study will aim to find out what factors motivate Corona vaccination attitudes and intentions in people. In more detail, the recorded data will be used to investigate to what extent factors such as current health condition, subjective norm, perceived vulnerability, and perceived severity towards the coronavirus can account for vaccine hesitancy (in form of attitude and intention) in people. The precise aim was not revealed before completion to prevent your responses from being influenced by personal dispositions.

Therefore, you will now be asked again for your consent. In case you want to withdraw from this study, you can still do so now. Then, your data will be deleted from the dataset.

- o I wish to remain participant of this study.
- o I wish to withdraw from this study.

Appendix D

Table 5

Scales, Items, Dimensionality, and Reliability of the Constructs (N = approximately 132)

Measures	Characteristics	
	Scale	Structure & reliability
1. Vulnerability	5-point Likert scale from 1=strongly agree to 5=strongly disagree	$\alpha = .85$
I feel that a corona infection would be harmful to me.		
A corona infection is bad for my health.		
A corona infection could get me seriously ill.		
A corona infection could not do me any harm. (R_i)		
After a corona infection, I would be weakened in health.		
2. Severity	5-point Likert scale from 1=strongly agree to 5=strongly disagree	$\alpha = .66$
I think that a coronavirus infection is bad for people's health.		
I feel that the coronavirus is worse than other diseases.		
The situation caused by the pandemic puts a burden on me.		
I feel that a coronavirus infection is harmless. (R_i)		
I think that a corona infection could strengthen the immune system. (R_i)		
3. Benefits of vaccination	5-point Likert scale from 1=strongly agree to 5=strongly disagree	$\alpha = .79$
With a corona vaccination, I would feel physically stronger.		
Without a corona vaccination, I could risk dying from the virus.		
I would feel relieved after I got vaccinated.		
With a corona vaccination, I help to stop the spread of the virus.		
Without a corona vaccination, I could risk getting seriously ill.		
4. Social norm	5-point Likert scale from 1=strongly	$\alpha = .61$

	agree to 5=strongly disagree	
The majority of people I know are willing to get vaccinated against Covid-19.		
The majority of people I know would encourage me to get a corona vaccination.		
I feel pressured by others to get vaccinated against corona.		
The majority of people in my environment think that corona vaccines are harmful. (R_i)		
The majority of people in my environment think that a corona vaccination is safe.		
5. Response-efficacy	5-point Likert scale from 1=strongly agree to 5=strongly disagree	$\alpha = .72$
Having a corona vaccination will protect me from the coronavirus.		
Only my natural immunity will protect me from the coronavirus. (R_i)		
With a corona vaccination, I would avoid getting seriously ill from the coronavirus.		
Without a corona vaccination, I will end up in hospitalization.		
Having a corona vaccination will not protect me from catching the virus. (R_i)		
6. Self-efficacy	5-point Likert scale from 1=strongly agree to 5=strongly disagree	$\alpha = .80$
I feel able to get vaccinated against corona.		
My body is strong enough for dealing with a corona vaccination.		
I think that I am mentally strong enough to take a corona vaccination.		
My body is not strong enough for dealing with a corona vaccination. (R_i)		
I feel able to deal with possible side-effects after a corona vaccination.		
7. Response cost	5-point Likert scale from 1=strongly agree to 5=strongly disagree	$\alpha = .63$
I feel that I have to overcome obstacles to get vaccinated against Covid-19.		
A corona vaccination could make me seriously ill.		
My body would easily handle a corona vaccination. (R_i)		
The majority of people in my environment would judge me for getting a corona vaccination.		
If I get vaccinated, I will have to deal with severe side-effects of the vaccination.		
8. Vaccination intention	5-point Likert scale from 1=strongly agree to	$\alpha = .96$

	5=strongly disagree	
When I am able to get a corona vaccination, I will get one.		
When I will receive an invitation to get vaccinated against corona, I will ignore it. (R_i)		
I will accept an invitation for a corona vaccination.		
I intend to get vaccinated against corona if it would help stop the spread of the virus.		
I intend to get vaccinated against corona if it meant protecting friends, family, or at-risk groups.		
9. Health condition	5-point Likert scale from 1=strongly agree to 5=strongly disagree	$\alpha = .63$
I feel physically healthy.		
I can live without medication.		
I can live without medical devices.		
I feel mentally healthy.		
10. Vaccine hesitancy	5-point Likert scale from 1=strongly agree to 5=strongly disagree	$\alpha = .90$
Corona vaccines make a lot of money for pharmaceutical companies, but do not do much for regular people.		
Authorities promote corona vaccination for financial gain, not for people's health.		
I would feel safe after being vaccinated against corona. (R_i)		
I can rely on the corona vaccines to stop further spreading of the coronavirus. (R_i)		
I would feel protected after getting vaccinated against corona. (R_i)		
Although corona vaccines appear to be safe, there may be problems that we have not yet discovered.		
Corona vaccines can cause unforeseen problems in people.		
I worry about the unknown effects of corona vaccines in the future.		
Corona vaccination programs are a big fraud.		
Natural immunity lasts longer than a corona vaccination.		
Natural exposure to the coronavirus gives the safest protection.		
Being exposed to the corona disease naturally is safer for the immune system than being exposed through a corona vaccination.		

Note. R_i: reversed item.

Appendix E

Table 6

Labelling for the Underlying Factors and Factor Loadings of the Vaccine Hesitancy Scale (N = approximately 132)

Item	Factor loadings & Factor labelling			
	Factor 1 = Natural exposure to virus	Factor 2 = Trust in the effectiveness of the vaccine	Factor 3 = Financial gain behind vaccines	Factor 4 = Unknown side-effects of the vaccine
1. Corona vaccines make a lot of money for pharmaceutical companies, but do not do much for regular people.			.85	
2. Authorities promote corona vaccination for financial gain, not for people's health.			.79	
3. I would feel safe after being vaccinated against corona.		.81		
4. I can rely on the corona vaccines to stop further spreading of the coronavirus.		.81		
5. I would feel protected after getting vaccinated against corona.		.82	.37	
6. Although corona vaccines appear to be safe, there may be problems that we have not yet discovered.				.82
7. Corona vaccines can cause unforeseen problems in people.				.81
8. I worry about the unknown effects of corona vaccines in the future.				.69
9. Corona vaccination programs are a big fraud.	.44		.68	
10. Natural immunity lasts longer than a corona vaccination	.74			
11. Natural exposure to the coronavirus gives the safest protection.	.89			
12. Being exposed to the corona disease naturally is safer for the immune system than being exposed through a corona vaccination.	.80			

Appendix F

‘Thank you for your time and participation, it is very much appreciated!

If you have any further questions or are interested in the results of the study, feel free to send an email to Sophia Paczulla; s.paczulla@student.utwente.nl.

Contact details for complaints about the research: Dr. Lyan Kamphuis-Blikman; l.j.m.blikman@utwente.nl.

Please share the link with others! Thank you very much!

Your response has been recorded.’