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What are the Determinants of the Protection Motivation Theory Predicting the Willingness to get Vaccinated Against Covid-19?

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Abstract

Vaccines are the most effective way to combat the Covid-19 pandemic. As many people as possible need to be vaccinated. However, not everyone is willing to get vaccinated in the first place. To be able to increase vaccination rates, it is relevant to know the reasons for people's vaccine hesitancy. Therefore, it is proposed that the Protection Motivation Theories constructs threat appraisal, response-efficacy, self-efficacy, and costs of adaptive behaviour mediate the relationship between the individual characteristics' conspiracy beliefs, vaccine scepticism, subjective well-being, and self-regulation with willingness to get vaccinated against Covid-19. To do so, a cross-sectional online survey with 113 participants was conducted. A mediation analysis was run to test whether the constructs of Protection Motivation Theory can account for the mediating role. It was found that response-efficacy mediates the relationship between vaccine scepticism and willingness to get vaccinated. People with higher vaccine scepticism have lower response efficacy and therefore, lower willingness to get vaccinated. Additionally, self-efficacy mediates the relationship between subjective well-being and willingness to get vaccinated. People with lower subjective well-being have lower self-efficacy and therefore lower willingness to get vaccinated against Covid-19. This study reveals that constructs from Protection Motivation Theory can be used by policymakers to increase willingness to get vaccinated against Covid-19 among citizens and deliver valuable insights in tackling further pandemics and other diseases.

What are the Determinants of the Protection Motivation Theory Predicting the Willingness to get Vaccinated Against Covid-19?

Every minute, about three humans lose their lives to diseases that could have been prevented by a vaccine (WHO, 2017). In 2019, Covid-19, which stands for Coronavirus Disease 2019 was discovered following an outbreak in Wuhan, China (WHO, 2020). It was declared a pandemic on March 11th 2020 (Venkatachary et al., 2020). About 20% of the people infected develop serious symptoms (WHO, 2020). Until June 2021, there were about 176 million confirmed cases and about 3.8 million deaths worldwide (WHO, 2021). Especially older individuals possess a high risk of suffering from severe symptoms (Rod et al., 2020). Covid-19 will not be the only pandemic that humanity has to deal with in the future. Although scientists are uncertain in the exact probability of possible outbreaks of pandemics, they do agree that global travel, increased population density, poverty, and megacities as well as closer contact to animal populations heighten the likelihood of zoonoses (Manheim, 2018). As data shows, vaccines are the most important tool when combatting infectious diseases (WHO, 2017).

However, in addition to getting vaccinated, several measures have been undertaken by countries to stop the spreading of the virus. Most measures are preventive measures that aim at preventing people from getting infected in the first place (Tanaya et al. 2020). These measures have shown to be effective in lowering the cases of new infections but are not able to defeat the virus and the pandemic itself (Vardoulakis et al., 2020). Therefore, these measures were always meant to bridge the time until vaccines against the virus were available. Until February 2021, there have been more than 50 vaccines in current development or clinical trials to combat Covid-19. The Pfitzer and BioNTech vaccine shows to be 95% effective after receiving the second dose (Mahase, 2020). Less than 1% of the participants experienced severe pain due to the vaccine which mainly showed itself in headaches or feelings of fatigue (Polack et al., 2020). The development of effective vaccines is a breakthrough in the fight against Covid-19. However, to stop the transmission of the virus at least between 60-75% of the population need to be vaccinated (Sallam, 2021). In contrast, in a survey conducted in the UK, 64% of the participants said that they would get a vaccination against Covid-19 (Sherman et al., 2020). If everyone who intends to, gets vaccinated, the number of vaccinated people would still be too low to reach immunity and stop the spread of the virus. Adding to that, only about 50% of human intentions are translated into actual behaviour (Sheeran & Webb, 2016). Therefore, high willingness to get vaccinated is important.

Research shows that theory-based interventions are more effective in increasing vaccination uptake (Stone et al., 2002). One study found that the Protection Motivation Theory

is effective in predicting the intention to get vaccinated in general (Allen & Butler, 2020). Until June 2021, there is little research available concerning the Protection Motivation Theory and Covid-19 vaccination combined.

Protection Motivation Theory focuses on explaining health-protective behaviours such as getting vaccinated. The Protection Motivation Theory was originally founded by Rogers to understand fear appeals (Conner, Norman, Boer & Seydel, 1996). Later, Rogers altered the Protection Motivation Theory to emphasize cognitive processes that lead to behaviour change. In the Protection Motivation Theory, there are response facilitating factors and response inhibiting factors that are weighted against each other. In terms of maladaptive responses, the response facilitating factors advantages of maladaptive behaviour are weighted against the response inhibiting factors severity of the threat and vulnerability of the individual towards the threat. Advantages of maladaptive behaviour are, for example, not getting vaccinated to avoid side effects. Severity is the assessment of the threat itself. In this case, how dangerous Covid-19 is to an individual's health. Vulnerability is an individual's assessment of the risk of getting the disease. In this case, how likely an infection with Covid-19 is. These processes determine the threat appraisal which means the overall threat of Covid-19 to the individual. In terms of adaptive responses, the response efficacy and self-efficacy are weighted against the costs of the adaptive behaviour. Response efficacy means that the individual assesses whether the recommended behaviour is effective in diminishing the threat (e.g., is the vaccination effective in protecting from Covid-19 symptoms or contracting the disease). Self-efficacy is the individuals' assessment of whether they can perform the recommended behaviour (e.g., actually getting a vaccination). These processes determine the individual's coping appraisal. After that, the threat appraisal and the coping appraisal determine whether an individual has a Protection Motivation against the threat. The Protection Motivation will lead to either adaptive or maladaptive coping depending on the individuals' characteristics in the different factors and, ultimately, to behaviour (Conner, Norman, Boer & Seydel, 1996). For example, people who see higher advantages of the behaviour, and value the threat as severe as well as themselves as being vulnerable towards the disease, will have a higher threat appraisal. If they also score high on response- and self-efficacy and perceive the costs of the adaptive behaviour as being low, they will score higher on coping appraisal. High threat appraisal and coping appraisal are hypothesized to lead to higher protection motivation and, therefore, to adaptive behaviour. Covid-19 is the threat while getting vaccinated against Covid-19 is the desired behaviour. Because of that, Protection Motivation will be operationalized as willingness to get vaccinated.

To increase the number of people willing to get vaccinated, more needs to be known about their reasoning why they do not want to get vaccinated. If their individual reasons are known, interventions could be targeted more efficiently towards them to decrease the translation gap between intention and behaviour (Sheeran & Webb, 2016). By that, vaccination rates could increase. Furthermore, these individual characteristics have shown to be highly context-specific, thus depending on the disease and its circumstances (MacDonald, 2015). Implementing the constructs from Protection Motivation Theory as a mediator might allow for generalisation of the findings to other diseases.

To be able to do that, it is relevant to know the factors that make persons vaccine-hesitant because these factors can change their vaccination behaviour. Vaccine hesitancy is the "delay in acceptance or refusal of vaccines despite availability of vaccination services" as defined by the SAGE working group (MacDonald, 2015). When looking at the intention to get vaccinated, several factors play a crucial role that can lead to vaccine hesitancy such as vaccine scepticism, conspiracy beliefs, subjective well-being and self-regulation.

The first factor that may predict the uptake of a Covid-19 vaccine is vaccine scepticism. Vaccine scepticism is people's beliefs about the dangers of vaccines (LaCour, & Davis, 2020). Further, it reflects basic cognitive differences in mortality-related event frequency estimation (LaCour, & Davis, 2020). Vaccines have saved uncountable lives and have increased life expectancy, quality of life and decreased suffering and the dangerousness of several diseases (Chatterjee, 2008). Still, the anti-vaccine movement established a link between vaccinations and autism to prove their point that vaccines may have adverse consequences for humans (Chatterjee, 2008). Especially for Covid-19 vaccinations, several factors may cause higher scepticism towards the vaccine. Regarding people's scepticism towards vaccines, one worry that many people have is the relatively short research process of vaccines (Seale et al., 2010). This reason may be especially relevant for Covid-19 vaccines, as the research and test phases have been shortened due to the urgency of a vaccine. This leads people to believe that the vaccine is not well tested and therefore might have adverse consequences. Consequently, people who have been sceptic towards vaccines may be even more sceptical towards a Covid-19 vaccine due to the shortened research process. However, even people who have not been sceptical may have become more sceptical than before. This may be related to the reports issued in March 2021 which established a link between Covid-19 vaccinations and the occurrence of thromboses in patients (Hunter, 2021). Many European countries stopped the vaccination with the linked vaccines for a certain period and adjusted their recommendations for certain groups of people. This event led to many critical comments regarding the safety of this vaccine and

may have caused scepticism among previously non-sceptic people. Vaccine scepticism implies that people do not believe that vaccines are safe in general. This may translate into low response-efficacy in terms of the vaccination. Therefore, people will not believe that the vaccination is effective in combatting Covid-19. This paper proposes that vaccine scepticism negatively influences response efficacy which ultimately decreases the intention to get vaccinated.

The second factor that may predict Covid-19 vaccine uptake is the belief in vaccine conspiracy beliefs (Jolley & Douglas, 2014). Conspiracy theories try to explain important political and social events with secret plots that are conducted by powerful actors (Pivetti et al., 2021). In terms of Covid-19, these theories include the idea that 5G towers are spreading Covid-19 or that pharmaceutical companies purposely spread the virus to make money with vaccines (Pivetti et al., 2021). Covid-19 conspiracy theories are closely related to general conspiracy beliefs (Pivetti et al., 2021). Furthermore, belief in conspiracy theories has been found to negatively predict the intention to get vaccinated against Covid-19 (Pivetti et al., 2021). Especially during the Covid-19 pandemic, conspiracy theories gained prominence (Earnshaw et al., 2020; Jolley & Douglas, 2014). Therefore, it is less likely to reach the intended minimum number of vaccinated people in society. Moreover, one factor that has not been researched extensively is the mediating role of constructs of the Protection Motivation Theory between conspiracy beliefs and willingness to get vaccinated (Pivetti et al., 2021). This study tries to shed more light on this question by proposing that constructs of the Protection Motivation theory can account for the mediating role as well. More specifically, threat appraisal of Covid-19 is the proposed mediator between conspiracy beliefs and intention to get vaccinated. Following this line of argumentation, it is not only relevant whether people believe in conspiracy theories, but also whether they believe the disease to be harmful to them. It is proposed that belief in conspiracy theories predicts threat appraisal of Covid-19, which in turn predicts intention to get vaccinated.

Especially in times of a pandemic where a lot of people are in lockdown, experience less social interaction, cannot follow all of their pre-pandemic activities and may experience physical health issues in case of an infection, subjective well-being may be impacted negatively. Subjective well-being is made up of three components (Diener, 1984). The first one is that it is entirely subjective which means that it is based upon the experiences of each individual. Furthermore, subjective well-being includes positive measures. This implies that it is not the sheer absence of negative experiences. The last component is that subjective well-being includes an overall assessment of an individual’s life which means that it tries to grasp as many

aspects of one's life as possible (Diener, 1984). If more people experience impaired subjective well-being, more people may be hesitant to get vaccinated because of the pandemic. A study conducted in the UK found an increase in suicidal thoughts in the population during the pandemic (O'Connor et al., 2020). Their study shows that especially women, people from the age 18-29, lower socioeconomic status groups, and people with a history of mental problems experienced a decrease in mental well-being. Additionally, during the influenza pandemic, subjective well-being was found to influence influenza vaccination (Bock et al., 2017). This may be because subjective well-being is associated with health preventive behaviour (Bock et al., 2017). Self-efficacy describes people's assessment of their ability to perform the health preventive behaviour, which is why self-efficacy may mediate the relationship between subjective well-being and willingness to get vaccinated.

Fourthly, self-regulation is the "effort by the human self to alter any of its own inner states or responses" (Vohs & Baumeister, 2016). This means that self-regulation is, on the one hand, the actual control one has of their own inner states like emotions. On the other hand, self-regulation measures the sheer attempt itself to control these inner states. Also, self-regulation was found to impact the willingness of taking short-term sacrifices to achieve long term benefits (Bock et al., 2017). In case of a possible Covid-19 vaccination, these short-term sacrifices may be side effects or taking the risk of a shorter research process of the vaccines. One major side effect discovered in March 2021 is the occurrence of thrombosis due to the AstraZeneca vaccination (Hunter, 2021). Furthermore, a long-term benefit is being vaccinated against Covid-19, thus being less at risk for a severe infection and less at risk for getting infected in the first place. Moreover, it is being debated whether people that have been vaccinated should get several advantages like being excluded from showing negative corona tests to get into restaurants. If there are fewer restrictions for people who are vaccinated in the future, a vaccination would offer a major long-term benefit in that respect. People who have high self-regulation may be more likely to accept possible short-term sacrifices to achieve long term benefits. Applying the scenario to the current pandemic, this means that people with high self-regulation would be more likely to get vaccinated and accept short-term risks like side effects. This is similar to the concept of costs of adaptive behaviour from the Protection Motivation Theory. That is why costs of adaptive behaviour may mediate the relationship between self-regulation and willingness to get vaccinated.

For every vaccine and its corresponding disease, the determinants that predict vaccine uptake may be different because the factors are usually context-specific and different for every vaccine (MacDonald, 2015). This means that influences like conspiracy theory beliefs may be

relevant for one disease in addressing vaccine uptake but may not be relevant in another disease. By applying four individual factors that may be relevant for Covid-19, this paper tries to identify disease-specific factors that explain Covid-19 vaccine uptake. Furthermore, Protection Motivation Theory has not widely been tested in regards to Covid-19 and whether it can predict vaccination behaviour for this disease. Applying Protection Motivation Theory to the Covid-19 pandemic may, on the one hand, lead to more insights on why people do get, or do not get vaccinated, and on the other hand, it may help policymakers for efficient vaccination campaigns to increase the number of people that are willing to get vaccinated. Consequently, this paper may contribute to a more efficient communication and strategy in combating vaccine hesitancy and ultimately, defeating Covid-19. This would make it easier to adjust to new diseases in the future and decrease vaccine hesitancy by actively focusing interventions on specific factors from the Protection Motivation Theory.

Following the determinants of people's intention to get vaccinated, the hypotheses below are proposed:

H1: *People with higher conspiracy beliefs have a lower threat appraisal and therefore a lower willingness to get vaccinated than people with lower conspiracy beliefs.*

This hypothesis is based on the assumption that people believing in conspiracy theories are in general less likely to get vaccinated (Pivetti et al., 2021). Furthermore, some conspiracy beliefs revolve around the idea that Covid-19 was introduced by higher powers for several reasons (Pivetti et al., 2021). This could lead people to believe that Covid-19 is not as dangerous as said. People who have lower threat appraisal would have less motivation to get vaccinated because they do not think they would have to protect themselves against the disease.

H2: People with higher vaccine scepticism have a lower response efficacy and therefore a lower willingness to get vaccinated than people with lower vaccine scepticism.

Hypothesis 2 is based on the assumption that people with higher vaccine scepticism do not trust efficacy of vaccines and their ability to protect against a disease (Chatterjee, 2008). People who do not believe in Covid-19 vaccines effectiveness are therefore assumed to have a lower willingness to get vaccinated.

H3: *People with lower subjective well-being have lower self-efficacy and therefore a lower willingness to get vaccinated than people with higher subjective well-being.*

This hypothesis is based on the assumption that higher subjective well-being was found to positively influence health-protective behaviour (Bock et al., 2017). The ability to protect oneself against a disease is also health-protective behaviour and therefore, it is assumed that lower subjective well-being leads to lower self-efficacy. Lower self-efficacy is thought to

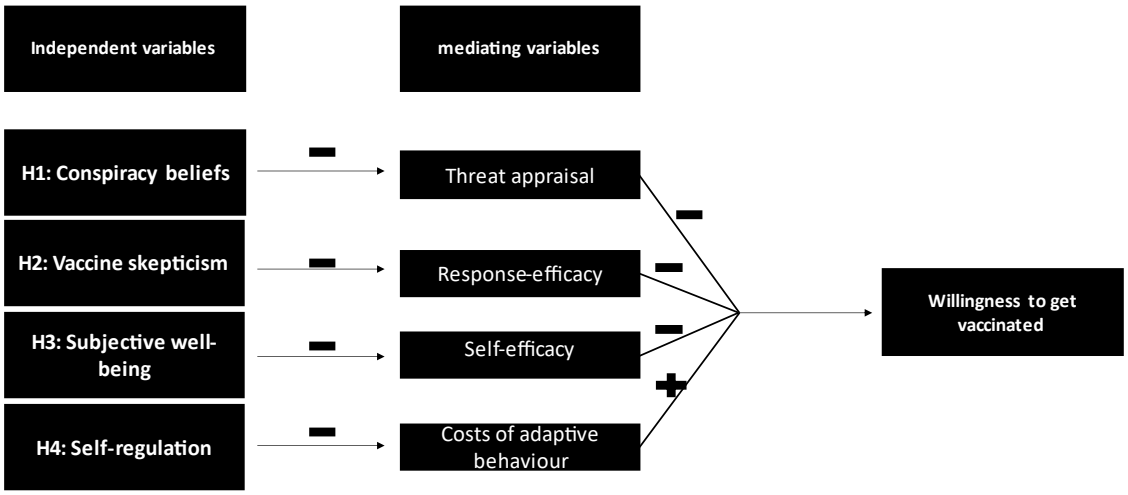
negatively impact willingness to get vaccinated. This means that people with low subjective well-being will likely be less willing to get vaccinated against Covid-19.

H4: *People with higher self-regulation have lower costs of adaptive behaviour and therefore a higher willingness to get vaccinated than people with lower self-regulation.*

This hypothesis is based on the assumption that higher self-regulation is associated with accepting short-term costs to gain long-term benefits (Bock et al., 2017). Therefore, it is hypothesized that higher self-regulation will lead to lower costs of adaptive behaviour. According to the Protection Motivation Theory, lower costs of adaptive behaviour predict health preventive behaviour, thus getting vaccinated.

Figure 1

Graphic depiction of hypotheses



2. Method

2.1 Design

The study was a cross-sectional survey as it measures individual characteristics at one point in time without manipulating either of the variables.

2.2 Participants

The participants were recruited using non-probability convenience sampling. The original dataset consisted of 167 responses. However, 34 responses were excluded from the analysis because they were responses from participants that were vaccinated already. A total of 15 responses were excluded as they did not fill out the questions regarding the Protection Motivation Theory, while 5 responses did not answer all the questions which led to a final dataset of N = 113 of which 69 were female, 41 male, 1 non-binary/third gender and 1 participant who did not want to specify their gender. The samples mean age was M = 23. Furthermore, most of the participants were students (81%) while 12% were employed full time. The same percentage of participants was employed part-time (12%). This was possible because

multiple answers were allowed as can be seen in *Table 1*. Finally, most of the participants were not thinking of a specific vaccine while filling out the survey (66%). However, if participants were thinking of a vaccine, most of them thought of Biontech/Pfitzer (22%), followed by AstraZeneca (8%). Moderna and Johnson & Johnson were each reported by one participant. Three participants thought of another vaccine that was not specified further.

2.3 Materials

During the study, a questionnaire created with the online survey platform Qualtrics was used. The questionnaire consisted of 60 questions. The questions asked for consent, the demographic variables age, occupation, and gender. Furthermore, the independent variables measured were subjective well-being, self-regulation, vaccine scepticism, and conspiracy beliefs. Additionally, self-efficacy, response efficacy, costs of adaptive behaviour, and threat appraisal were the mediating variables from the Protection Motivation Theory that were measured. Lastly, the dependent variable willingness to get vaccinated and the filter variable vaccination status were measured as well.

2.4 Instruments

For the assessment of vaccine scepticism, a shortened version of the vaccine scepticism scale consisting of 9 items was adapted from LaCour and Davis (2020). Items were reworded so that they would fit the topic at hand. Furthermore, responses were recorded on a 5-Point-Likert scale (1 = *Disagree strongly* to 5 = *Agree strongly*). Participants had to answer questions regarding the safety of Covid-19 vaccines (e.g., “Covid-19 vaccines can lead to allergies”) and about the role of higher powers regarding Covid-19 vaccination (e.g., “People have been deceived about Covid-19 vaccine safety”). The scale for vaccine scepticism showed good reliability (α = .88) and meritorious validity (KMO = .89; Bartlett Test = .0).

To assess conspiracy beliefs, a shortened version of the Generic Conspiracist Beliefs scale consisting of 7 items was used (Brotherton et al., 2013). Participants had to answer questions regarding their conspiracy believes (e.g., “The power held by heads of state is second to that of small unknown groups who really control world politics” or “Technology with mind control capacities is used on people without their knowledge”). This shortened scale showed good reliability (α = .86) and meritorious validity (KMO = .84; Bartlett Test = .0).

Table 1

Demographics

Characteristic	Full sample	
	n	%
Gender		
Female	69	61.1
Male	41	36.3
Non-Binary/third gender	1	0.9
Prefer not to say	1	0.9
Other	3	2,7
Current occupation level		
Employed full time	13	11.5
Employed part-time	13	11.5
Unemployed looking for work	2	1.8
Unemployed not looking for work	0	0
Retired	1	0.9
Student	92	81.4
Other	2	1.8
Vaccine control		
Biontech/Pfitzer	25	22.1
AstraZeneca	9	8
Moderna	1	0.9
Johnson & Johnson	1	0.9
Other	3	2.7
No specific vaccine	74	65.5

Further, to assess subjective well-being, a shortened version consisting of 13 items from the BBB subjective well-being scale (BBC-SWB) was used (Pontin et al., 2013). The scale of Pontin et al. (2013) dealt with the domain's psychological well-being (e.g., "I feel depressed or anxious"), physical health, well-being (e.g., "I am happy with my physical health"), and relationships (e.g., "I am happy with my friendships and personal relationships"). The scale showed good reliability (α = .88) and meritorious validity (KMO = .83; Bartlett Test = .0).

Furthermore, a shortened version consisting of 10 items of the Self-regulation Questionnaire (SRQ) from Pichardo-Martinez et al. (2014) was used. The scale measured goal setting (e.g., "I set goals for myself and keep track of my progress"), perseverance (e.g.," I have

a lot of willpower"), and decision making (e.g.," When it comes to deciding about a change, I feel overwhelmed by the choices"). The scale showed good reliability (α = .83) and meritorious validity (KMO = .84; Bartlett Test = .0).

The scales used to test the constructs of the Protection Motivation Theory were adapted from Lwin and Saw (2007). The items have been rewritten to fit the topic of Covid-19 vaccinations. The response efficacy scale consisted of 3 items (e.g., "Getting vaccinated against Covid-19 will help prevent me from getting infected with Covid-19") and yielded acceptable reliability (α = .7) and mediocre validity (KMO = .62; Bartlett Test = .0).

The scale used to measure self-efficacy consisted of 5 items (e.g., "I am confident of my ability to get vaccinated against Covid-19") and showed acceptable reliability (α = .7) and mediocre validity (KMO = .63; Bartlett Test = .0).

Furthermore, the scale measuring costs of adaptive behaviour consisted of 3 items (e.g., "It is time-consuming for me to get vaccinated against Covid-19") and showed unacceptable reliability (α = .35) and miserable validity (KMO = .55; Bartlett Test = .04). Therefore, a factor analysis was performed to check whether there are more constructs measured by this scale. Results showed that this scale has one underlying factor as can be seen in *Table 2.*

The scale measuring threat appraisal consisted of 2 items (e.g., "I am at high risk of becoming seriously ill from COVID-19") and has been adapted from the construct's severity and vulnerability. This scale showed good reliability (α = .82) and miserable validity (KMO = .5; Bartlett Test = .0).

Lastly, the scale measuring willingness to get vaccinated consisted of 2 items (e.g., "I intend to ensure that I get vaccinated against Covid-19") and showed excellent reliability (α = .93) and miserable validity (KMO = .5; Bartlett Test = .0).

Table 1

Factor Analysis

Costs of adaptive behaviour item	Factor loading
	1
Costs of adaptive behaviour	
It is time-consuming for me to get vaccinated against Covid-19	**.68**
It is not convenient for me to get vaccinated against Covid-19	**.74**
Vaccination leads to me suffering from side-effects	**.55**

Note. *N* = **113. Factor loadings above .30 are in bold. Reverse-scored items are denoted with (R). Adapted from** "Lwin, M. O., & Saw, S. M. (2007). Protecting children from myopia: a pmt perspective for improving health marketing communications. *Journal of Health Communication*, *12*(3), 251–68 (https://doi.org/10.1080/10810730701266299)"

2.5 Procedure

After the study has been reviewed and accepted by the ethics board of the University of Twente, the survey was published on the website SONA, which gives students from the University of Twente access to several studies. Furthermore, participants were recruited via social media, more specifically Instagram and WhatsApp. When starting the survey, participants were informed about the topic of the research first. They were given a text with more information about the purpose of the research, possible harms, and the researchers' contact information. They were also informed that they are allowed to withdraw from the study at any time without giving any reason. After they were informed about the confidentiality of their data, participants were asked to give their active consent. For participants who did not agree to take part in the study, the survey ended here. If participants gave their consent, they were asked demographic questions about their age, gender, and current occupation. In the following, participants were asked to what extent they agreed with statements about their subjective well-being, self-regulation, vaccine scepticism, and conspiracy beliefs. All answers were recorded using a 5-Point-Likert scale. Next, participants were asked whether they have already been vaccinated against Covid-19. If yes, the survey ended for them. For those participants that answered no, questions testing constructs of the Protection Motivation Theory were asked. Those constructs include response-efficacy, costs of adaptive behaviour, self-efficacy, threat appraisal and willingness to get vaccinated. In the end, participants were asked to state whether they have thought of a specific vaccine, and if yes, which one, while filling out the survey to be able to control for a possible effect of the vaccine on the willingness to get vaccinated. After that, participants were thanked for their participation and told that their response has been recorded and that they may close the survey.

2.6 Statistical analysis

In order to test the hypotheses, a simple mediation analysis was performed using the SPSS add-on PROCESS. Furthermore, a correlational analysis has been carried out to display the correlations between the instruments themselves.

3. Results

3.1 Instrument means

Vaccine scepticism has a mean of $M = 2.1$ ($SD = .8$). Furthermore, conspiracy beliefs show the lowest mean ($M = 1.9$, $SD = .8$). The mean for subjective well-being is $M = 3.5$ ($SD = .6$) while the mean for self-regulation is $M = 3.4$ ($SD = .7$). The mean for response efficacy is $M = 3.8$ ($SD = .9$) while the self-efficacy mean is $M = 4.1$ ($SD = .6$). Costs of adaptive behaviour

has a mean of $M = 2.1$ ($SD = .7$). Additionally, threat appraisal has a mean of $M = 2.3$ ($SD = 1.1$) while willingness to get vaccinated shows the highest mean ($M = 4.4$, $SD = 1.0$).

These values suggest that vaccine scepticism, conspiracy beliefs and costs of adaptive behaviour are relatively low in this sample. This shows that this sample has a generally high willingness to get vaccinated. Furthermore, the sample's means on the scales that are hypothesized to increase willingness to get vaccinated (subjective well-being, self-regulation, response efficacy and self-efficacy) are relatively high compared to the means on the scales that are hypothesized to decrease willingness to get vaccinated (vaccine scepticism, conspiracy beliefs and costs of adaptive behaviour). However, the mean of the scale measuring threat appraisal is in between these two different groups and shows the highest standard deviation.

3.2 Correlational analysis

To be able to get an overview over the correlations between the different items, a correlation analysis was carried out. Vaccine scepticism has a significantly negative correlation with response efficacy ($r = -.5$, $p < .001$), and willingness to get vaccinated ($r = -.77$, $p <. 001$). As can be seen in *Table 3*, conspiracy beliefs has a significantly negative correlation willingness to get vaccinated ($r = -.56$, $p < .001$). It does not significantly correlate with threat appraisal ($r = -.01$, $p = .89$). The correlation analysis reveals that subjective well-being has a significantly positive correlation self-efficacy ($r = .32$, $p < .001$). Also, subjective well-being does not have a significant relationship with willingness to get vaccinated ($r = .1$, $p = .31$). Self-regulation does not show any significant correlations with costs of adaptive behaviour ($r = -.08$, $p = .42$) or willingness to get vaccinated ($r = -.06$, $p = .50$). Response efficacy has a significantly positive correlation with willingness to get vaccinated ($r = .53$, $p < .001$) while costs of adaptive behaviour has a significantly negative correlation willingness to get vaccinated ($r = -.41$, $p < .001$). Lastly, self-efficacy correlates significantly positive with willingness to get vaccinated ($r = .51$, $p < .001$).

Table 2

Descriptive Statistics and Correlations for Study Variables

Variable	M	SD	1	2	3	4	5	6	7	8	9
1. subjective well-being	3.5	.6	—								
2. self-regulation	3.4	.7	.57**	—							
3. vaccine sceptisicm	2.1	.8	-.21**	-.04	—						
4. conspiracy beliefs	1.9	.8	-.22*	-.12	.65**	—					
5. response efficacy	3.8	.9	.16	-.02	-.50**	-.45**	—				
6. costs adaptive behaviour	2.1	.7	-.07	-.08	.45**	.42**	-.18	—			
7. self-efficacy	4.1	.6	.32**	.17	-.62**	-.46**	.44**	-.40**	—		
8. threat appraisal	2.3	1.1	-.21*	-.07	-.10	-.01	.21*	-.11	-.06	—	
9. willingness to get vaccinated	4.4	1.0	.10	-.06	-.77**	-.56**	.53**	-.41**	.51**	.21**	—

*$p < .05$, two-tailed. **$p < .01$, two-tailed.

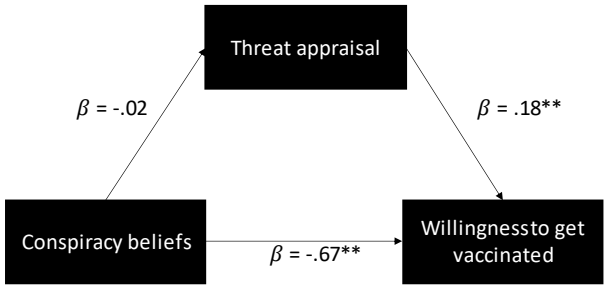
3.3 Mediation effects analysis

As can be seen in *Figure 2,* Hypothesis 1 states that *people with higher conspiracy beliefs have a lower threat appraisal and therefore a lower willingness to get vaccinated than people with lower conspiracy beliefs.* Results show that conspiracy beliefs have an insignificant direct effect on threat appraisal (β = -.02, p = .89). Conspiracy beliefs show a significant direct effect on willingness to get vaccinated (β = -.67, $p < .001$). Threat appraisal has a significant direct effect on willingness to get vaccinated (β = .18, p = .01) which is also in line with the hypothesis expecting that low threat appraisal leads to lower willingness to get vaccinated. The total effect of conspiracy beliefs on willingness to get vaccinated is similar to the direct effect of conspiracy beliefs in willingness to get vaccinated (β = -.68, $p < .001$). The indirect effect of

conspiracy beliefs on willingness to get vaccinated was found to be statistically insignificant [β = -.00, 95% C.I. (-.04, .05)]. The Sobel test yielded insignificant results (Sobel test = -.15; p = .88). Therefore, the hypothesis that the effect of conspiracy beliefs on willingness to get vaccinated is mediated by threat appraisal is rejected.

Figure 2

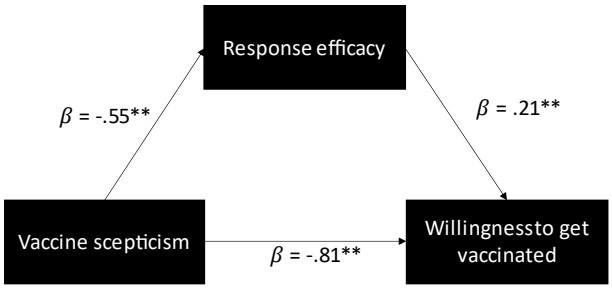
Results of testing Hypothesis 1



As can be seen in *Figure 3*, H2 states that *people with higher vaccine scepticism have a lower response efficacy and therefore a lower willingness to get vaccinated than people with lower vaccine scepticism*. The original direct effect of vaccine scepticism on willingness to get vaccinated shows a significant direct effect (β = -.81; p < .001). Vaccine scepticism's direct effect on response efficacy is significant as well (β = -.55; p < .001). This effect is in line with the hypothesized effect as high vaccine scepticism predicts low response efficacy. Response efficacy also shows a significant direct effect on willingness to get vaccinated (β = .21; p = .01) which is also in line with the hypothesis as low response efficacy leads to lower protection motivation. The total effect of the model is larger than the direct effect of vaccine scepticism on willingness to get vaccinated (β = -.93, p < .05). This means that there is mediation, but only partial as the original direct effect is not equal to zero. The indirect effect of vaccine scepticism on willingness to get vaccinated via moderation was found to be statistically significant [β = -.11; 95% C.I. (-.26, -.02)]. Additionally, the Sobel Test yielded significant results (Sobel test = -2.51; p = .01). Therefore, the hypothesis that high vaccine scepticism leads to low response efficacy, which in turn leads to lower willingness to get vaccinated, is accepted. However, the mediation is only partial as vaccine scepticism's effect is only reduced in size and not equal to zero.

Figure 3

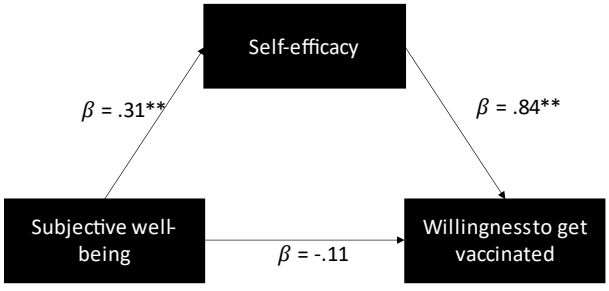
Results of testing Hypothesis 2



As can be seen in *Figure 4*, H3 states that p*eople with lower subjective well-being have lower self-efficacy and therefore, lower willingness to get vaccinated than people with higher subjective well-being*. Subjective well-being has a significant direct effect on self-efficacy (β = .31, p < .001) which is in line with the hypothesized effect that lower subjective well-being leads to lower self-efficacy. Self-efficacy has a significant direct effect on willingness to get vaccinated (β = .84, p < .001) which also corresponds with the hypothesis which states that lower self-efficacy leads to lower willingness to get vaccinated. Furthermore, subjective well-being has an insignificant direct effect on willingness to get vaccinated (β = -.11, p = .41). The total effect of the model is larger than the direct effect of subjective well-being on willingness to get vaccinated but shows to be insignificant (β = .15, p = .31). The indirect effect of subjective well-being on willingness to get vaccinated was found to be statistically significant [β = .26, 95% C.I. (.12, .45)]. The Sobel test yielded significant results as well (Sobel test = 3.04; p < .05). Therefore, the hypothesis that the effect of subjective well-being on willingness to get vaccinated is mediated by self-efficacy, is accepted.

Figure 4

Results of testing Hypothesis 3

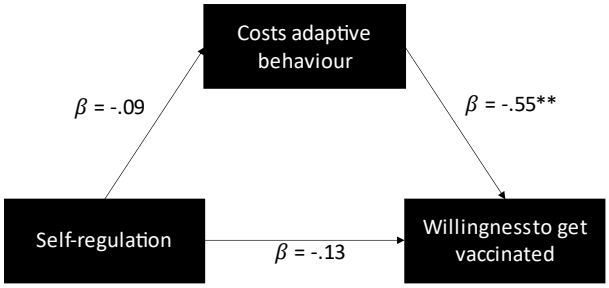


As can be seen in *Figure 5*, H4 states that p*eople with higher self-regulation have lower costs of adaptive behaviour and therefore a higher willingness to get vaccinated than people with lower self-regulation*. Self-regulation has a statistically insignificant direct effect on costs of adaptive behaviour (β = -.09, p = .42). Furthermore, self-regulation has a statistically

insignificant direct effect on willingness to get vaccinated (β = -.13, p = .30). Costs of adaptive behaviour have a statistically significant direct effect on willingness to get vaccinated (β = -.55, p < .001) which is in line with the hypothesis that lower costs of adaptive behaviour lead to higher willingness to get vaccinated. The total effect of the model shows to be insignificant and lower than the original direct effect (β = -.08, p = .54). The indirect effect of self-regulation on willingness to get vaccinated was found to be statistically insignificant [β = .05, 95% C.I. (-.08, .17)]. The Sobel test yielded insignificant results as well (Sobel test = .81; p = .42). Therefore, the hypothesis is rejected.

Figure 5

Results of testing Hypothesis 4



4. Discussion

This study aimed at identifying whether constructs from Protection Motivation Theory can account for the mediating role between individual characteristics and the willingness to get vaccinated against Covid-19. The individual characteristics of vaccine scepticism, conspiracy beliefs, subjective well-being and self-regulation were investigated in a sample of 113 individuals via an online study. Protection Motivation Theory is a widely used model in determining whether people would protect themselves against a certain threat. However, especially pandemics have been found to be context-specific, thus individual characteristics and threat assessment vary between different threats. On the one hand, specific influences on people's willingness to get vaccinated can be uncovered by applying Protection Motivation Theory. On the other hand, applying factors from Protection Motivation Theory may also allow generalisation as the model can be applied to different threats. In this sample, self-efficacy and response-efficacy were identified as mediators in determining people's willingness to get vaccinated.

When looking at the hypotheses, Hypotheses 2 and 3 are confirmed. Hypothesis 2 states that *people with higher vaccine scepticism have a lower response efficacy and therefore a lower willingness to get vaccinated than people with lower vaccine scepticism*. This means that people who are more sceptical of vaccines, in general, do not trust the efficacy of vaccines and their

ability to protect them against Covid-19. This, in turn, leads to them being less willing to get vaccinated than people who are less sceptical of vaccines. Also, response efficacy acts as a mediator between vaccine scepticism and willingness to get vaccinated. Especially during the Covid-19 pandemic scepticism might have been higher than for other diseases as the research process of the vaccine was shorter. Additionally, issues were reported in March 2021 regarding the occurrence of thromboses in vaccinated people (Seale et al., 2010; Hunter, 2021). Therefore, possibly fewer people are willing to get vaccinated against Covid-19. This study examined the characteristics and beliefs causing such behaviour.

Hypothesis 3 states that *people with lower subjective well-being have lower self-efficacy and therefore, a lower willingness to get vaccinated than people with higher subjective well-being.* As this hypothesis is confirmed as well, it is apparent that people who experience lower subjective well-being have a lower self-efficacy, which translates into a lower willingness to get vaccinated. This result is in line with findings from the influenza pandemic in which subjective well-being was found to impact willingness to get vaccinated (Bock et al., 2017). As higher subjective well-being is associated with health preventive behaviour, higher subjective well-being translates into self-efficacy. During the Covid-19 pandemic, mental health was found to be decreasing among citizens (O'Connor et al., 2020). This shows that higher subjective well-being seems to be an important factor when wanting to increase people's willingness to get vaccinated. Furthermore, self-efficacy was found to partially mediate the relationship between subjective well-being and willingness to get vaccinated. This shows that subjective well-being still has a strong direct impact on willingness to get vaccinated. Self-efficacy can only account for some part of the relationship between subjective well-being and willingness to get vaccinated.

Hypotheses 1 and 4 were rejected. Hypothesis 1 states that *people with higher conspiracy beliefs have a lower threat appraisal and therefore a lower willingness to get vaccinated than people with lower conspiracy beliefs.* It was proposed that people who believe in conspiracy beliefs are more likely to adopt conspiracy theories revolving around Covid-19. Therefore, they might perceive the threat as small and decrease willingness to get vaccinated against Covid-19. However, threat appraisal does not mediate the relationship between conspiracy beliefs and willingness to get vaccinated. People believing in conspiracy theories do not have a higher threat appraisal than people who do not believe in them. At the same time, in line with previous findings, conspiracy beliefs were found to have a direct influence on willingness to get vaccinated (Pivetti et al., 2021). The fact that threat appraisal does not account for the mediating role, might be because conspiracy beliefs do not necessarily imply that people

rate the threat as being lower. For example, believing in the conspiracy theory that Covid-19 was purposely released by the pharmaceutical industry does not say anything about the actual threat. So, people might think that the disease was released on purpose, but also think that the threat is actually higher. In fact, from their point of view, it could also make sense to rate the threat of the disease as high because more dangerous diseases would lead to more profit for pharmaceutical companies.

Hypothesis 4, which states that *people with higher self-regulation have lower costs of adaptive behaviour and therefore a higher willingness to get vaccinated than people with lower self-regulation*, was not confirmed in this sample. The proposed hypothesis was based on the association of self-regulation with accepting short-term costs for long-term benefits which would then translate into a higher willingness to get vaccinated (Bock et al., 2017). However, this effect is not mediated by costs of adaptive behaviour in this sample. This might be caused by self-regulation being associated with accepting short-term sacrifices to have long-term benefits. Consequently, possible side effects might not be seen as short-term sacrifices due to an often relatively short time of suffering from side effects (if even). Also, long-term benefits are not clearly defined regarding their time frame. For Covid-19 vaccinations, long-term benefits may already occur a few days after vaccination, causing some protection against severe courses of infection. Therefore, the short-term sacrifices are minimal compared to the benefits that often occur after a few days.

Even though this study produced several significant results, there are some limitations to the study. Firstly, this study made use of only a few constructs of the Protection Motivation Theory and not all of them. Protection Motivation Theory takes into account all of the constructs to determine protection motivation. In this study, singular constructs were picked and predicted protection motivation with every one of them individually. Furthermore, willingness to get vaccinated does not equal the number of people actually getting vaccinated as there is an intention-behaviour gap (Sheeran & Webb, 2016). Therefore, only the intention could be measured and not whether the intention will be translated into real-life behaviour. To account for that in further studies, a follow-up questionnaire could be added, asking participants whether they got vaccinated. By comparing this to their willingness to get vaccinated it can be measured how effective Protection Motivation Theory is in predicting vaccination behaviour. Additionally, this study worked with a very young and educated sample as the average age was 23 years and about 80% of the sample were students. This decreases the generalisation of the results onto older and less educated people. Therefore, a wider range of age groups and professions should be included in following studies.

Regarding the limitations of the study, further research should apply the whole Protection Motivation Theory on willingness to get vaccinated to account for all of the constructs of Protection Motivation Theory. This could enable a better overview of which factors influence willingness to get vaccinated the most. Furthermore, further research should also focus on determining the intention-behaviour gap for Covid-19 vaccination as this might translate to future pandemics as well. By doing so, a rough estimate of the gap could emphasise the percentage of people needed to be willing to get vaccinated to reach the minimum number of people who actually get vaccinated to reach herd immunity. Further research should also take different age groups into account. This sample was very young and therefore, the findings may not apply to other age groups as well. For example, this study found subjective well-being to be an important factor when determining willingness to get vaccinated. However, a prior study found that especially women and younger people experienced decreased mental well-being during the pandemic (O'Connor et al., 2020). Therefore, subjective well-being in this sample may have been lower and more influential compared to other samples. Furthermore, this sample was highly educated. Less educated samples may deliver different results. If people in higher educated samples are prone to believe in conspiracy theories, they may be able to distinguish that from reasonable arguments speaking in favour of getting vaccinated. For example, if someone believes that Covid-19 was released purposely to gain financial profit, they may still be able to perceive the disease as a threat nevertheless and get vaccinated. This may not apply to samples with lower education as they might not be able to distinguish between credible and unreliable sources as well. Furthermore, as this study tested every mediation effect separately instead of testing the complete model, future studies should test the complete model. The purpose of this study was to test whether the variables themselves have an impact on willingness to get vaccinated. Further studies should test the whole model based focusing on the relevant variables, in this case, vaccine scepticism, subjective well-being, response-efficacy and self-efficacy. Lastly, further research should focus on determining whether Protection Motivation Theory can predict willingness to get vaccinated for other pandemics and diseases. This could show whether the finding that Protection Motivation Theory can partially account as a mediator between individual characteristics and willingness to get vaccinated are generalisable.

There are several implications of this study for practice. Firstly, this study showed that Protection Motivation Theory constructs can partially account as a mediator for the relationship between individual characteristics such as vaccine scepticism and willingness to get vaccinated. Subsequently, Protection Motivation Theory can be used to determine whether people would get vaccinated in case of a pandemic or against a certain disease. Therefore, policies should

focus on the constructs response-efficacy and self-efficacy when trying to convince more people to get vaccinated against Covid-19. If governments aim at increasing these two constructs, overall willingness to get vaccinated would increase. These two constructs could also be highly relevant for future pandemics if Protection Motivation Theory shows to apply to other diseases. Consequently, politics could improve the efficiency of their vaccination campaigns which would lead to fewer cases of infections and fewer deaths worldwide.

Moreover, this study found subjective well-being as being highly relevant for people's self-efficacy. If governments aim to increase subjective well-being in society (during the pandemic), self-efficacy could improve and, therefore, willingness to get vaccinated would increase. However, this is probably a long-term plan as increasing subjective well-being takes time. If future research finds that subjective well-being is relevant for other diseases or pandemics as well, politics could focus on offering more and better help to citizens at the beginning of a pandemic already. This would lead to more people wanting to get vaccinated as soon as a vaccine is available.

Furthermore, vaccine scepticism was found to influence response efficacy and, subsequently, willingness to get vaccinated. Politics should focus on decreasing vaccine scepticism in society to increase response efficacy to make more people willing to get vaccinated. If vaccine scepticism shows to be influential for other diseases as well, politics should aim interventions at decreasing scepticism in the population. However, this study only examined scepticism towards Covid-19 vaccinations which makes the results less generalisable as scepticism could be less for different vaccinations. Especially since it was declared that vaccinations could lead to an increased risk of thrombosis may lead to more vaccine scepticism towards Covid-19 vaccinations (Hunter, 2021) in March 2021. Following, politics first prohibited vaccinations with the given vaccine, only to allow vaccinations again shortly after. This may have increased vaccine scepticism as well. Politics should focus on more efficient crisis communication in these events to decrease vaccine scepticism and, therefore, increase response efficacy and willingness to get vaccinated.

In conclusion, this study showed that the constructs of the Protection Motivation Theory can explain the relationship between individual characteristics and willingness to get vaccinated during the Covid-19 pandemic. Response-efficacy and self-efficacy have been found to be influential on people's willingness to get vaccinated. These findings can be utilized by policymakers in their vaccination campaigns. Moreover, if these findings show to apply to future pandemics, politics may be prepared better in terms of their knowledge of what influences people's willingness to get vaccinated. Furthermore, subjective well-being has been

found to influence self-efficacy and vaccine scepticism has been found to influence response-efficacy. These findings can also be used to increase willingness to get vaccinated if policy focuses on decreasing subjective well-being among citizens. The same accounts for vaccine scepticism, which needs to be reduced to increase response efficacy and, thus, willingness to get vaccinated.

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Appendix

Table 4

Psychometric Properties for Scales

Scale	M	SD	KMO	Bartlett Test	Cronbach's α
Vaccine scepticism	2.1	.8	.89	.0	.88
Conspiracy beliefs	1.9	.8	.84	.0	.86
Subjective well-being	3.52	.63	.83	.0	.88
Self-regulation	3.42	.69	.84	.0	.83
Response efficacy	3.84	.88	.62	.0	.7
Self-efficacy	4.1	.62	.63	.0	.7
Costs of adaptive behaviour	2.08	.74	.55	.04	.35
Threat appraisal	2.26	1.1	.5	.0	.82
Willingness to get vaccinated	4.43	.97	.5	.0	.93