Predictors of the Willingness of Young Adults to get Vaccinated Against Covid-19

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Abstract

Objective: The novel Coronavirus-2019 (Covid-19) has been affecting the lives of people since the end of 2019 and has caused the death of more than three million people worldwide so far. Due to the severity and high mortality of Covid-19, countries are hoping to achieve herd immunity through vaccination as fast as possible, however, this can only be guaranteed if 70% or more of the citizens of a country are immune. At the beginning of the pandemic, young adults aged 18 to 30 have been shown to be the least willing to get vaccinated against Covid-19. Therefore, this study examined factors related to young adults' willingness to get a Covid-19 vaccine, including demographic factors and the factors of the Secondary Risk Theory (SRT), a model concerned with threat perception based on the Protection Motivation Theory (PMT). It was further examined if the SRT offered an improved explanation of young adults' Covid-19 vaccine intention than the PMT.

Method: An online cross-sectional survey study was conducted from the 24th of March until the 10th of April 2021 where 259 participants filled out a questionnaire concerning the SRT and vaccine intention, out of which 213 participants were validated for the analysis.

Results: The results showed that general Covid-19 vaccine willingness of young adults was high (85.4%). When compared to the PMT, the SRT offered an improved explanation of young adults' willingness to get vaccinated against Covid-19. Especially perceived secondary risk severity, which is the perceived harmfulness of engaging in a protective behaviour, was a strong predictor of vaccine willingness. No demographic factors were significantly associated with young adults' Covid-19 vaccine intention.

Conclusion: This study suggests that greater emphasis should be put on communication about secondary risk factors of Covid-19 vaccines, despite growing numbers in vaccine willingness. The results imply that the SRT offers an improved explanation of young adults' willingness to get vaccinated against Covid-19, however, since the SRT is a relatively new model, more research is needed to confirm these findings. Nevertheless, it is suggested that the SRT may be used to explain individuals' health protective behaviour in different contexts, as well as it should be determined whether similar results are found in different age groups, or in the same age group but with differing levels of education since the majority of participants in this study were university students.

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Introduction

The Coronavirus disease (Covid-19), a disease caused by the novel coronavirus SARS-CoV-2, has been holding the world in its grip ever since its first appearance at the end of 2019 (World Health Organization, 2020c). The most common symptoms upon Covid-19 infection are fever, dry cough and fatigue (World Health Organization, 2020c). In severe cases, Covid-19 can cause a shortness of breath, high temperature, loss of appetite, confusion, and persistent pain or pressure in the chest (World Health Organization, 2020c). Covid-19 has created a global crisis with devastating social, economic, and health impacts (Walsh, 2020; World Health Organization, 2020b). Even though around 80% of those who develop symptoms recover from Covid-19 without needing to be treated in hospital, the virus has been the cause of death of over 2.27 million people on earth to this day (World Health Organization, 2020b). Covid-19 can affect any individual regardless of age, however, people aged 60 years and older as well as individuals with underlying medical problems are especially at risk of developing severe symptoms of Covid-19 (World Health Organization, 2020c). Moreover, since Covid-19 is a previously unknown disease, little is known about future harmful consequences. As of June 2021, fatigue, shortness of breath, chest pain, muscle aches, headaches, heart palpitations, loss of smell and suffering from depression or memory deficits have been found as long lasting symptoms after Covid-19 infection and it is yet to be known how long these harmful symptoms can persist (Rijksinstituut voor Volksgezondheid en Milieu, n.d.). Thus, due to the severity and high mortality of the disease, countries are hoping to achieve herd immunity through vaccination as fast as possible. Herd immunity can be reached when 70% of the population is protected against the disease (European Commission, 2021). However, it is uncertain whether the number of individuals willing to get vaccinated is high enough to achieve this goal (Neumann-Böhme et al., 2020). For example, Covid-19 vaccination willingness amongst Germans is currently at 67.8%, which is too low to successfully reach herd immunity (Robert Koch Institut, 2021b). On the other hand, countries such as the Netherlands show an overall willingness of 76%, but these numbers vary greatly between the different age groups. Whereas 92% of individuals aged 70 or older wish to be vaccinated against Covid-19, only 62% of 16 to 24 year olds and 69% of 25 to 39 year olds are willing to get the vaccine (Rijksoverheid, n.d.). Similarly, the willingness of German citizens aged 65 and above was 92% in May 2021, while only 63% of 18 to 39 years olds indicated that they would certainly get vaccinated against Covid-19 (Heinrich, 2021). In accordance with this, other studies have further found young adults to be the age group most reluctant towards Covid-19 vaccination (Hamel, Kirzinger,

Muñana & Brodie, 2020; Yoda & Katsuyama, 2021). Simultaneously, young adults are the main transmitters of Covid-19, and while they themselves typically develop less severe symptoms upon Covid-19 infection, they carry a greater risk of harming vulnerable others close to them, such as parents or grandparents (Boehmer et al., 2020; World Health Organization, 2020a). Therefore, in order to lower the transmission of Covid-19 and ensure that herd immunity will indeed be reached, it is necessary to target those groups who are less willing to get vaccinated. Hence, this study aims to explore factors influencing the willingness of young adults to get vaccinated against Covid-19.

To this date, vaccines are one of the most effective ways to avoid disease (World Health Organization, 2019). At this point in time, multiple manufacturers are aiming to create safe vaccines that will prevent individuals' future infection with Covid-19. In the EU, four Covid-19 vaccines by the companies BioNTech and Pfizer, Moderna, AstraZeneca and Janssen Pharmaceutica NV are currently approved by the European Medicines Agency. All four vaccines allow individuals to create a protein from SARS-CoV-2, thereby protecting the body against future infections, although it is currently still undetermined how long this protection is lasting (European Medicines Agency, n.d.). In EU countries such as Germany and the Netherlands, the previously described risk group and individuals working in the medical sectors who are in contact with the risk group are usually the first people to receive Covid-19 vaccination (Gezondheidsraad, 2020; Robert Koch Institut, 2021a). Young adults are set to receive the vaccine at last, as they are less likely to develop severe symptoms of Covid-19 (Government of the Netherlands, 2021).

However, despite the development of safe Covid-19 vaccinations, vaccine intention varies greatly. While some research is claiming that Covid-19 vaccine acceptance is declining (Attwell et al., 2021; Szilagyi et al., 2020), other studies report that the number of people who are willing to get vaccinated against Covid-19 is increasing (Hamel et al., 2020; Rijksoverheid, n.d.). For example, the Rijksoverheid (n.d) has reported that Covid-19 vaccine willingness in the Netherlands has risen from 48% in November 2020 to 76% in March 2021. On the other hand, a survey by YouGov and the Imperial College London (2021) reports that vaccine intention in the European countries France, Denmark, Spain, France, Germany, Sweden and the UK has been slightly declining between February and March 2021. All named countries despite France, where intention to get vaccinated against Covid-19 dropped from 47% to 44%, had a vaccine intention between 61% (Germany) and 75% (Denmark and the UK) in March, compared to 64% (Germany) and 82% (Denmark) a month prior. In accordance with this, Lazarus et al. (2020) found that while individuals in Asian countries, namely China, South

Korea and Singapore, showed a Covid-19 vaccine acceptance level of 80% or above, the numbers for European countries were considerably lower, such as in Germany (69%), the UK (74%) or France (60%). Their study highlights that these differences in the uptake of Covid-19 vaccination may delay global control of Covid-19 (Lazarus et al., 2020). Thus, these mixed results should be taken seriously, as it is uncertain whether herd immunity can be achieved with those individuals willing to get vaccinated against Covid-19 alone (Neumann-Böhme et al., 2020). Therefore, it is necessary to create successful Covid-19 vaccine promotions that will target individuals or groups unwilling or hesitant about Covid-19 vaccination.

As mentioned before, one of these groups are young adults aged 18 to 30. Younger individuals are usually healthier than older individuals and are less likely to develop severe symptoms or decease upon Covid-19 infection (Bai, 2020; Rijksoverheid, 2021). At the same time, younger individuals are the main transmitters of Covid-19. Because their symptoms upon Covid-19 infection are oftentimes mild to none at all, many young adults are unaware that they are carrying the disease, thereby heightening the risk of unknowingly transmitting the disease to others (World Health Organization, 2020a). In accordance with this, Boehmer et al. (2020) have found that an increase of Covid-19 infection among young adults was subsequently followed by an increased amount of infections among older adults, thus highlighting the impact young adults' increased Covid-19 infections have on older individuals. Moreover, next to the high possibility of infecting others, getting Covid-19 may have other negative consequences for young adults, such as having to stay in quarantine and therefore not being able to engage in usual activities.

Despite this, research has shown that young adults are generally less willing to get vaccinated against Covid-19 when compared to older individuals (Hamel et al., 2020; Yoda & Katsuyama, 2021). Young adults up to the age of 24 seem to be especially reluctant to get vaccinated against Covid-19. For example, Neumann-Böhme et al. (2020) have found that European males and females aged 18 to 24 are the most hesitant to get vaccinated against Covid-19. Similarly, the Dutch government identified young adults aged 16 to 24 as the least willing to get vaccinated against Covid-19 when compared to all other age groups, shortly followed by the 25 to 39 year olds (Rijksoverheid, n.d.).

Even though young adults are considered the main transmitters of Covid-19, little research has been done on them in specific. Obtaining information on young adults could be effectively used for health campaigns aimed at those who are less willing to get vaccinated against Covid-19, particularly since young adults are at a higher risk of infecting vulnerable

groups. In order to do this, factors that influence the willingness of young adults to get vaccinated against Covid-19 have to be established.

So far, research has found various factors associated with Covid-19 vaccination intention that can help create successful vaccine promotions. These include trust in government (Guidry et al., 2021), trust in the healthcare system and vaccine manufacturers (Wong et al., 2021) and knowledge on Covid-19 vaccination (Ruiz & Bell, 2021). In addition, gender may be associated with individuals' willingness to get vaccinated against Covid-19. Previous studies on the general public have found males to be slightly less likely to be willing to get a Covid-19 vaccine (Lazarus et al., 2020). On the other hand, a study by Karlsson et al. (2021) has found no significant association between Covid-19 vaccine intention and gender. Yet another study analysed sixty research papers on Covid-19 vaccine intention and found that over half of the studies reported men to be more willing to get vaccinated against Covid-19 (Zintel et al., 2021). However, no study has focused on gender differences in young adults in specific. Therefore, this research will explore whether gender can be associated with young adults' willingness to get vaccinated against Covid-19.

As mentioned before, Lazarus et al. (2020) have found that Covid-19 vaccination acceptance varies between the different countries worldwide. Yet, up to this point the possible association between young adults' nationality and their willingness to get vaccinated against Covid-19 has not been researched. Thus, this study is looking at young adults' country of birth inside Europe and if it can be associated with their willingness to get vaccinated against Covid-19.

This study will further look at the living circumstances of young adults. As mentioned before, research has shown that young adults are the main transmitters of Covid-19 (World Health Organization, 2020a). Once infected, all other individuals living in the same household are at an increased risk of a Covid-19 infection (Public Health England, 2021). Especially those young adults living together with someone in the risk group are asked to be especially careful in their everyday life (Public Health England, 2021). However, it is currently unknown whether sharing a household with individuals in the risk group is associated with young adults' willingness to get vaccinated against Covid-19.

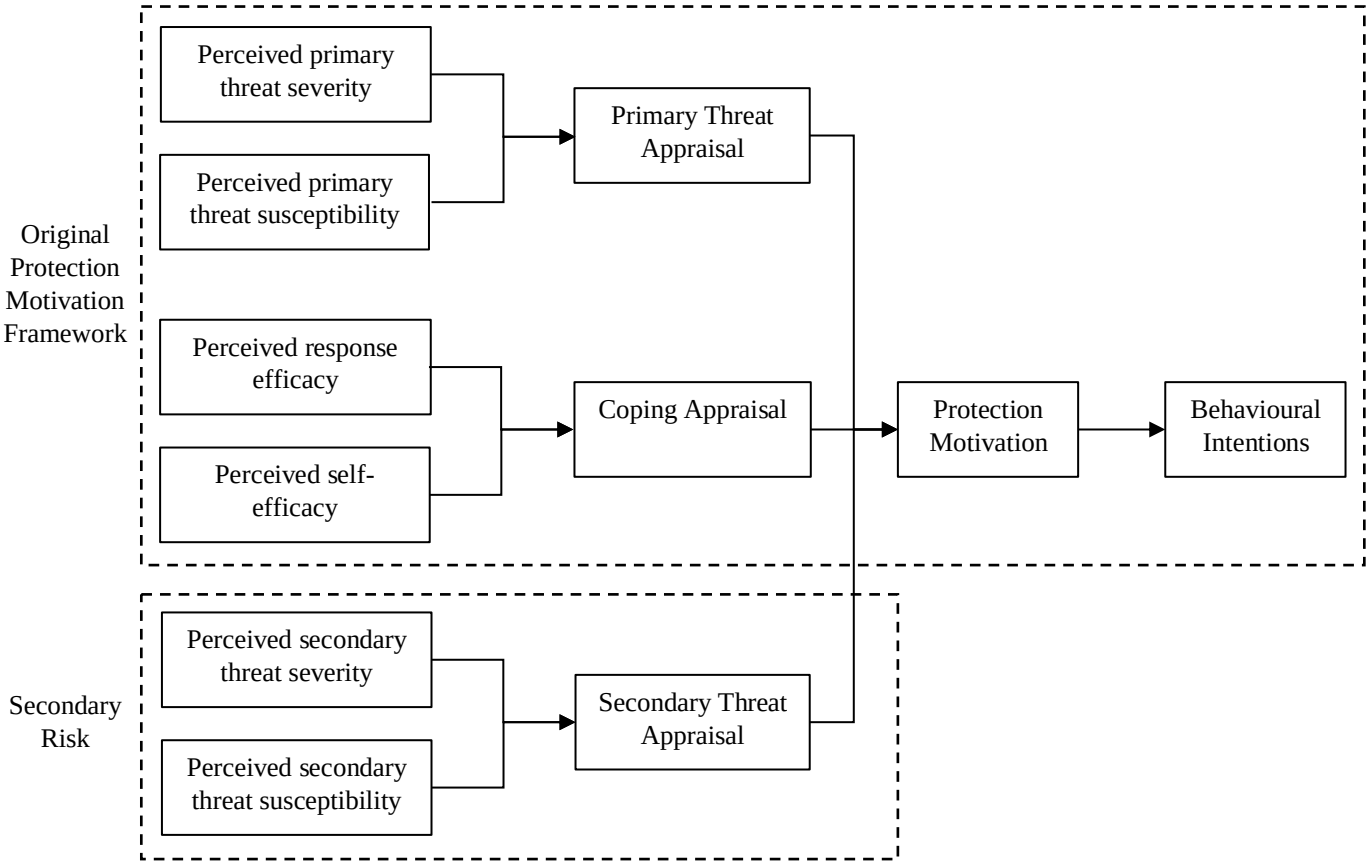
In addition to this, this study is focusing on possible underlying health conditions and their association with young adults' willingness to get vaccinated against Covid-19. Next to individuals aged 60 years and older, people suffering from diabetes or chronic diseases such as asthma or Parkinson's disease, as well as those with a weakened immune system due to, for example, chemotherapy or HIV and AIDS, are especially at risk of developing severe

symptoms upon Covid-19 infection (Centers for Disease and Control Prevention, 2021; Rijksoverheid, n.d.).

Another factor possibly explaining vaccine uptake is threat perception. Morrison and Bennett (2017) have argued that differing threat perceptions of illnesses may play a role in vaccine acceptance. A disease considered threatening would have a higher vaccination uptake than a disease considered less serious (Morrison & Bennett, 2017). This is in line with the Secondary Risk Theory (SRT; Cummings, Rosenthal & Kong, 2020, see *Figure 1*), adapted from the Protection Motivation Theory (PMT; Maddux & Rogers, 1983).

Figure 1

Model of the Secondary Risk Theory as Developed by Cummings et al. (2020)



Like the PMT, the SRT argues that a higher primary risk perception, which describes the perceived seriousness of and perceived vulnerability to a threatening event, and higher coping abilities increase protective behaviour. Here, protective behaviour can include any behaviour that aims to prevent or reduce the health threat, such as getting vaccinated against a disease (Floyd, Prentice-Dunn, & Rogers, 2000). However, the SRT adds that a high secondary risk perception, which describes the perceived risks associated with engaging in protective

behaviour, decreases protective behaviour, even if levels of primary risk perception and coping abilities are high (Cummings et al., 2020). The SRT is using the factors of the PMT whilst simultaneously offering more precise predictions on individuals' willingness to engage in self-protective behaviours, such as getting vaccinated, thus allowing improved prediction and promotion of protective behaviour without disregarding the usefulness of the original PMT (Cummings et al., 2020). In their study, Cummings et al. (2020) successfully tested the effectiveness of the SRT on explaining individuals' willingness to get vaccinated, finding that it was better at explaining protective behaviour than the PMT and therefore offering more precise information on individuals' engagement in protective behaviours that may be used to improve health-promoting campaigns.

Since the SRT builds on the PMT, it is utilising most of the original framework of the PMT. The PMT was developed to explain individuals' risk perception and their intention to change (Maddux & Rogers, 1983). The PMT argues that individuals respond to information either in an adaptive or maladaptive manner, depending on their appraisal of the threat and their perceived coping abilities to minimise the threat. For individuals to react in an adaptive manner and engage in the protective behaviour, they would have to consider a disease threatening, as well as they would have to feel able to protect themselves against that disease (Maddux & Rogers, 1983). Here, the SRT differs from the PMT, as it argues that secondary threat appraisal, which describes the associated risks of engaging in the protective behaviour, is crucial to determine whether a person will actually react in an adaptive manner (Cummings et al., 2020).

More specifically, the SRT is divided into three parts that assess individuals' intention to change: primary threat appraisal, coping appraisal and secondary threat appraisal (Cummings et al., 2020; Maddux & Rogers, 1983).

Primary threat appraisal consists of the perceived primary threat severity and the perceived primary threat susceptibility (Cummings et al., 2020; Maddux & Rogers, 1983). Perceived primary threat severity describes individuals' subjective perception of the severity of a disease, whilst perceived primary threat susceptibility is referring to individuals' perceived risk of getting infected with the disease.

Coping appraisal includes perceived response efficacy and perceived self-efficacy (Maddux & Rogers, 1983). Perceived response efficacy describes individuals' perceived effectiveness of protective behaviour in order to prevent the disease. Self-efficacy refers to an individuals' level of confidence that they are able to take protective action.

Secondary threat appraisal involves perceived secondary threat severity and perceived secondary threat susceptibility (Cummings et al., 2020). Perceived secondary threat severity

describes the perceived harmfulness of engaging in a protective behaviour, whereas perceived secondary threat susceptibility is defined as the perceived likelihood of being harmed by a protective behaviour.

A higher score on perceived primary threat appraisal and perceived coping appraisal generally increases the likelihood of engaging in protective behaviours (Maddux & Rogers, 1983). However, the SRT says that even if primary threat appraisal and coping appraisal are high, once individuals' secondary threat appraisal is high as well, protective behaviour will be much lower than what the original PMT would have predicted (Cummings et al., 2020). Therefore, for an individual to react in an adaptive manner, they would have to consider a disease as threatening, feel able to protect themselves against the disease, and believe that the protective behaviour, such as getting vaccinated, is not threatening. On the other hand, low levels of primary threat appraisal and coping appraisal result in a maladaptive response, meaning that an individual will not take action to protect themselves and others, regardless of secondary threat appraisal (Cummings et al., 2020; Maddux & Rogers, 1983).

Whereas there have been studies on the association between the PMT and Covid-19, there has not been a study on the association between the SRT and Covid-19 vaccine intention, despite the SRT offering more precise results. In support of the PMT, Kim and Crimmins (2021) have found that high perceived response efficacy and high perceived self-efficacy can be associated with young adults' engagement in protective behaviours. Similarly, in their study on the willingness of Europeans to get vaccinated against Covid-19, Neumann-Böhme et al. (2020) have found an association between the belief that Covid-19 is not dangerous to one's health and not wanting to get vaccinated. Another study on the PMT by Kowalski and Black (2020) found that health messages highlighting the severity of Covid-19 and promoting protective behaviours against Covid-19 were most successful in promoting health protective behaviour. However, the studies on the PMT were obtained before vaccination against Covid-19 had begun. Nevertheless, PMT has oftentimes been used to determine individuals' willingness to get vaccinated against other diseases. For example, Liu, Nicholas and Jian (2020) have found that the PMT factors severity and self-efficacy are associated with individuals' intention to get vaccinated against the hepatitis b virus.

On the other hand, Antonopoulou et al. (2020) have found that promotional health messages targeting Covid-19 beliefs such as knowledge of vaccine safety or perceived benefits of receiving a vaccine are more successful than those targeting individuals' primary threat appraisal. This supports the study by Cummings et al. (2020), which says that secondary threat appraisal is crucial in determining individuals' engagement in protective behaviour. In

addition, possible side effects of the vaccine and worries that Covid-19 vaccines may not be safe have been associated with reduced willingness of individuals to get vaccinated against Covid-19 (Neumann-Böhme et al., 2020). However, as mentioned before, there is currently no research available specifically focusing on the factors of the SRT and its association with individuals' willingness to get vaccinated against Covid-19. Therefore, it is yet unknown whether the SRT is indeed offering a better explanation of individuals' intention to get vaccinated against Covid-19. Thus, this study will look at the factors of the SRT and determine whether there is an association between the SRT and young adults' willingness to get vaccinated against Covid-19, and whether this association offers an improved explanation when compared to the PMT.

Based on this, this research is exploring the following questions.

1. How high is the willingness of young adults to get vaccinated?

2. How strong is the relationship between the factors of the Secondary Risk Theory and young adults' willingness to get vaccinated against Covid-19?

3. To what degree is gender associated with young adults' willingness to get vaccinated against Covid-19 and the factors of the Secondary Risk Theory?

4. How strong is the association between nationality, young adults' willingness to get vaccinated against Covid-19 and the factors of the Secondary Risk Theory?

5. To what degree is living with someone at high risk of developing severe symptoms of Covid-19 associated with young adults' willingness to get vaccinated against Covid-19 and the factors of the Secondary Risk Theory?

6. To what degree is having an underlying health condition associated with young adults' willingness to get vaccinated against Covid-19 and the factors of the Secondary Risk Theory?

7. Does the Secondary Risk Theory offer an improved explanation of young adults' willingness to get vaccinated against Covid-19 than the Protection Motivation Theory?

Method

Participants

The questionnaire was completed by a total of 259 adult volunteers, recruited through convenience sampling as well as through SONA, a subjects pool offered by the Behavioural, Management and Social Sciences faculty of the University of Twente. Psychology and Communication Science students can obtain course credits for participating in studies offered on the SONA system. The convenience sample was collected within the personal environment of the researcher. All participants were asked to agree to an informed consent form before being able to proceed with the survey. The survey was approved by the ethics committee of the Behavioural, Management and Social Sciences faculty of the University of Twente (approval number 210223) and conducted from the 24th of March until the 10th of April 2021.

One participant was excluded because they did not agree to the consent form. Nine participants were excluded because they did not finish the study. In addition, eight participants were excluded as they did not fall into the age range of 18 to 30. 23 participants who indicated that they already had a Covid-19 infection, as well as five other participants who had already received their Covid-19 vaccination were further excluded from the analysis. This is because individuals in either condition have developed a certain degree of immunity against Covid-19 (Reynolds, 2021) and in countries such as Germany, the Covid-19 restrictions have already been eased for those individuals who have recovered from a Covid-19 infection or have been vaccinated against Covid-19 (Bundesregierung Deutschland, 2021).

Thus, the data of 213 participants was used in this study (see *Table 1*). Out of these 241 participants, 62.9% were German, 15% were Dutch, 4.2% were Italian, 2.8% were British, 1.9% were French and 13.2% had a different nationality. The age ranged from 18 to 30 years (M=21.8, SD=2.343). Over half of the participants were female (67.1%). The majority of participants were students (89.7%) and most participants (48.8%) lived in a shared accommodation. 8% of participants had an underlying health condition.

Table 1

Sociodemographic Characteristics of Participants

Demographic Factor	*n*	*%*	*M*	*SD*	*min*	*max*
Gender						
Male	68	31.9				
Female	143	67.1				
Diverse[a]	1	0.5				
Prefer not to say[b]	1	0.5				
Age			21.8	2.3	18	30
Nationality						
Dutch	32	15				
German	134	62.9				
Other	47	22.1				
Country of Residence						
Netherlands	103	48.4				
Germany	86	40.4				
Other	24	11.3				
Occupation						
Student	191	89.7				
Unemployed	2	0.9				
Working full-time (30 hours or more a week)	15	7				
Working part-time (less than 30 hours a week)	3	1.4				
Other	2	0.9				
Living circumstances						
Shared accommodation	104	48.8				
With mother or father	67	31.5				
With partner	17	8				
Alone	15	7				
Other	10	4.7				
Living with someone in the risk group						
Yes	38	17.8				
No	175	82.2				

Table 1 *continued.*

Demographic Factor	*n*	*%*	*M*	*SD*	*min*	*max*
Having underlying health conditions						
Yes	17	8				
No	196	92				

[a] Due to the low number of diverse individuals, they were excluded from further analysis involving gender

[b] Individuals who preferred not to tell their gender were excluded from further analysis involving gender

Materials

The questionnaire was administered in English and was created through online program Qualtrics (see *Appendix A* for all items of the questionnaire). The questionnaire was developed by the researcher to explore predictors of young adults' willingness to get vaccinated.

The 11 variables measured by the questionnaire were 'willingness to get vaccinated against Covid-19', 'perceived primary risk severity', 'perceived primary risk susceptibility', 'response efficacy', 'self-efficacy', 'perceived secondary risk severity', 'perceived secondary risk susceptibility', 'gender', 'nationality', 'living circumstances', and 'underlying health conditions'. 'Willingness to get vaccinated against Covid-19' acted as the dependent variable (DV) of the study. The independent variables (IV) were 'perceived primary risk severity', 'perceived primary risk susceptibility', 'response efficacy', 'self-efficacy', 'perceived secondary risk severity', 'perceived secondary risk susceptibility', 'gender', 'nationality', 'living circumstances' and 'underlying health conditions'. The materials used for this study was a questionnaire with a total of 28 items.

Demographics

The questionnaire started by asking for participants' demographic data, including age, gender, nationality, living circumstances, educational level and working situation. In addition to asking for the participants' living circumstances, they were further asked if they are currently living together with someone who is especially at risk of developing severe symptoms of Covid-19. Moreover, participants were asked to indicate whether they have one or more of the underlying health conditions that puts them at risk of developing severe symptoms upon Covid-19 infection (Centers for Disease and Control Prevention, 2021; Rijksoverheid, n.d.). They were provided with examples of applicable underlying health conditions, more specifically chronic respiratory disease, heart disease, chronic kidney disease, liver disease, weakened immune system, diabetes, as well as severe obesity (Rijksoverheid, n.d.). Then, participants

were asked “Are you yourself part of this risk group?” to which they were asked to answer with ‘yes’, ‘no’ or ‘prefer not to say’.

Intention to get a Covid-19 vaccine

Participants’ intention to get a Covid-19 vaccine was measured by asking them to rate the statement “When I get invited to get a Covid-19 vaccine, I will take it.” Participants were able to indicate their agreement on a five-point Likert scale ranging from ‘no, I certainly will not’, ‘no, I probably will not’, ‘undecided/I do not know’, ‘yes, I probably will’ to ‘yes, I certainly will’. Scores ranged from 1, ‘no, I certainly will not’, to 5, ‘yes, I certainly will’. Scores of 1 or 2 corresponded with a low intention to get vaccinated, whereas a score of 3 was considered undecided. Scores of 4 and above corresponded to a high intention to get vaccinated.

Secondary Risk Theory

In order to measure SRT, a total of 19 items combining the factors of the PMT and SRT in relation to Covid-19 were created. The items were adapted from the Covid-19 related questionnaires of Antonopoulou et al. (2020) and Graffigna, Palemenghi, Boccia and Barello (2020). Cronbach’s Alpha was calculated for all items belonging to each construct to determine their reliability. All items used a five-point Likert scale ranging from ‘completely disagree’, ‘somewhat disagree’, ‘neutral/no opinion’, ‘somewhat agree’ to ‘completely agree’. For each variable of the SRT, that is primary risk severity, primary risk susceptibility, response efficacy, self-efficacy, secondary risk severity and secondary risk susceptibility, at least two items were used.

To begin with, primary risk severity was assessed through four statements, the first one being “I will be very sick if I get Covid-19” followed by “Covid-19 is no worse than the seasonal flu”, “I am concerned that people I know will get infected with Covid-19” and “I am concerned that I will infect others with Covid-19”. Cronbach’s alpha was .54. To increase the reliability of the construct, the item “Covid-19 is no worse than the seasonal flu” was removed from the analysis. The improved Cronbach’s alpha was .66.

Three items were used to measure participants’ primary risk susceptibility. These were “I believe that I am at high risk of catching Covid-19 when compared to others”, “I am safe from getting Covid-19” and “I am less likely than other people to get Covid-19”. Primary risk susceptibility contained two reversed items and had a Cronbach’s alpha of .66.

Participants' response efficacy was assessed through four items, namely "If I receive a Covid-19 vaccine, I will be protected against Covid-19", "If I have a Covid-19 vaccine, I will not be able to spread Covid-19 to others", "If I have a Covid-19 vaccine, I will not have to socially distance anymore to protect others from Covid-19" and "Getting a Covid-19 vaccination will help my country get back to normal". Cronbach's alpha was .61.

Self-efficacy was measured using three statements. These were "I feel in control as to whether I will have a Covid-19 vaccine", "Once I get invited, it would be easy for me to schedule a Covid-19 vaccination appointment if I wanted to" and "I can choose if I want to be vaccinated against Covid-19". Self-efficacy had a Cronbach's alpha of .57.

Participants' secondary risk severity was measured through the three statements "Side effects of Covid-19 vaccines are severe", "I feel that getting a vaccine against Covid-19 is harmful for me" and "Covid-19 vaccination is safe", "I worry about the unknown effects of vaccines against Covid-19". Secondary risk severity contained one reversed item and had a Cronbach's alpha of .85.

Lastly, secondary risk susceptibility was measured through three statements. These were "I am concerned about experiencing side effects from a Covid-19 vaccine" and "If I receive a Covid-19 vaccine, I am safe from getting its side effects" and "I am at a higher risk of getting side effects from a Covid-19 vaccine compared to others". Cronbach's alpha was .49.

Design and Procedure

The participants were able to access the survey through SONA or by being provided with a link to the survey by the researcher through social media platforms or direct messaging. To begin with, the participants received general information about the questionnaire. They were further told that it would take around 15 minutes to complete. Then, the participants were asked to agree to an informed consent form by clicking "I agree." Next, they were asked about some of their demographics and filled in the questionnaire.

Data Analysis

Data analysis was performed using the statistical software SPSS (Version 27). An alpha level of .05 was used for all statistical tests. All tests were obtained by performing bootstrapping.

To answer the first research question "How high is the willingness of young adults to get vaccinated?", a mean score of participants' intention to get vaccinated was calculated. In addition, a frequency analysis was used to determine the percentages for each response option.

A t-test was used to answer the third research question “To what degree is gender associated with young adults’ willingness to get vaccinated against Covid-19?”.

In order to answer the fourth research question “How strong is the association between nationality and young adults’ willingness to get vaccinated against Covid-19?” a one way ANOVA was used to compare the scores between nationality and intention to get vaccinated against Covid-19.

For the fifth research question “To what degree is living with someone at high risk of developing severe symptoms of Covid-19 associated with young adults’ willingness to get vaccinated against Covid-19?”, the two scores, not living with someone in the risk group and living with someone in the risk group, were compared with a t-test.

To answer the sixth research question “To what degree is having an underlying health condition associated with young adults’ willingness to get vaccinated against Covid-19?”, a t-test was used to compare vaccine intention between the two groups, namely having an underlying health condition and not having an underlying condition.

Finally, all demographics that showed a significant relationship with vaccine intention were tested in a multiple regression analysis.

For the second research question “How strong is the relationship between the Secondary Risk Theory and young adults’ willingness to get vaccinated against Covid-19?”, the mean scores for each factor of the SRT were established. Afterwards, the univariate correlations between demographic factors, vaccine intention and the factors of the Secondary Risk Theory were calculated. Then, a hierarchical regression analysis was used to test the multivariate relationships between the factors of the SRT and vaccine intention, as well as significantly associated demographic factors. Next to this, a multiple regression analysis was used to exclusively test the PMT factors. This was done to answer the seventh research question “Does the Secondary Risk Theory offer an improved explanation of young adults’ willingness to get vaccinated against Covid-19 than the Protection Motivation Theory?”. The two results were compared to test whether the SRT gives an improved explanation of young adults’ willingness to get vaccinated when compared to the PMT or not.

Results

Young adults’ intention to get vaccinated against Covid-19

First, the frequencies of young adults' willingness to get vaccinated against Covid-19 were determined (see *Table 2*). The mean score of young adults' vaccine intention was 4.34 (*SD*=1.04).

Table 2

Young Adults' Intention to Receive a Covid-19 Vaccine (N= 213)

Covid-19 vaccine intention	*n*	%	*M*	*SD*	Median	IQR[a]	
						Q1	*Q3*
No, I certainly will not	8	3.8					
No, I probably will not	10	4.7					
I do not know	13	6.1					
Yes, I probably will	52	24.4					
Yes, I certainly will	130	61					
Total	213	100	4.3	1.0	5.0	4.0	5.0

[a] IQR = Interquartile Range

Gender differences in vaccine intention

Next, it was examined whether gender could be associated with young adults' willingness to get vaccinated against Covid-19. The mean scores of vaccine intention showcase that females indicated a higher mean willingness to get vaccinated against Covid-19 when compared to males, but this difference was not significant (see *Table 3*).

Table 3

Covid-19 Vaccine Intention in Men and Women

	Male (*n*=68)				Female (*n*=143)				*t*(94.868)	*p*	Cohen's *d*
	M	*SD*	95% CI[a]		*M*	*SD*	95% CI[a]				
			LL[b]	*UL*[c]			*LL*[b]	*UL*[c]			
Vaccine Intention	4.2	1.3	3.9	4.5	4.4	.87	4.2	4.5	-.84	.40	-.14

[a] CI = Confidence Interval, [b] LL = Lower Level, [c] UL = Upper Level

Association between nationality and vaccine intention

As can be seen in *Table 4,* the mean vaccine intention scores were the highest for Dutch participants. An one-way analysis of variance obtained by performing bootstrapping showed

that there was no significant association between young adults' nationality and Covid-19 vaccine intention ($F(2, 210)=.274$, $p=.761$).

Table 4

Covid-19 Vaccine Intention per Nationality

	Dutch (*n*=32)				German (*n*=134)				Other (*n*=47)				*F*(2, 210)	*p*
	M	*SD*	95% CI[a]		*M*	*SD*	95% CI[a]		*M*	*SD*	95% CI[a]			
			LL[b]	*UL*[c]			*LL*[b]	*UL*[c]			*LL*[b]	*UL*[c]		
Vaccine Intention	4.5	.84	4.2	4.7	4.3	1.1	4.1	4.5	4.3	1.0	4.0	4.6	.27	.76

[a] CI = Confidence Interval, [b] LL = Lower Level, [c] UL = Upper Level

Association between living circumstances and vaccine intention

Then, it was examined whether living with someone in the risk group could be associated with young adults' willingness to get vaccinated against Covid-19. As can be seen on *Table 5*, a t-test obtained by performing bootstrapping showed no significant association ($t(211)=.511$, $p=.61$).

Table 5

Differences in Covid-19 Vaccine Intention Between Participants who are Living and Not Living with Someone at High Risk of Developing Severe Symptoms Upon Covid-19 Infection

	Living with risk group (*n*=38)				Not living with risk group (*n*=175)				*t*(211)	*p*	Cohen's *d*
	M	*SD*	95% CI[a]		*M*	*SD*	95% CI[a]				
			LL[b]	*UL*[c]			*LL*[b]	*UL*[c]			
Vaccine Intention	4.4	.92	4.1	4.7	4.3	1.1	4.2	4.5	.51	.61	.09

[a] CI = Confidence Interval, [b] LL = Lower Level, [c] UL = Upper Level

Association between underlying health conditions and vaccine intention

A t-test calculated by performing bootstrapping showed no significant association between having an underlying health condition that puts one at an increased risk to get severe symptoms upon Covid-19 infection and the willingness to get vaccinated against Covid-19 ($t(211)=.042$, $p=.966$, see *Table 6*).

Table 6

Differences in Covid-19 Vaccine Intention Between Individuals With and Without Underlying Health Conditions

	Individuals with underlying health condition (*n*=17)				Individuals without underlying health condition (*n*=296)				*t*(211)	*p*	Cohen's *d*
	M	*SD*	95% CI[a]		*M*	*SD*	95% CI[a]				
			LL[b]	*UL*[c]			*LL*[b]	*UL*[c]			
Vaccine Intention	4.4	1.2	3.7	4.9	4.3	1.0	4.2	4.5	.04	.97	.01

[a] CI = Confidence Interval, [b] LL = Lower Level, [c] UL = Upper Level

Association between Protection Motivation Theory, Secondary Risk Theory and vaccine intention

The mean scores of each construct were conducted. Mean scores for the individual items of each construct can be found in *Appendix B.* A Pearson correlation showed significant correlations between all constructs of the SRT and vaccine intention (see *Table 7*). Primary risk severity and primary risk susceptibility both had a weak positive correlation with vaccine intention. Response efficacy and self-efficacy were each moderately positively correlated to vaccine intention. Secondary risk severity showed a strong negative correlation with vaccine intention. Similarly, secondary risk susceptibility showed a moderate negative correlation with vaccine intention.

Table 7

Means and Correlations for the Secondary Risk Theory Constructs and Vaccine Intention

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Vaccine Intention	4.3	1.0	-						
2. Primary Risk Severity	3.9	.76	.30*	-					
3. Primary Risk Susceptibility	3.3	.78	.23*	.34*	-				
4. Response Efficacy	3.2	.67	.45*	.10*	.10*	-			
5. Self-Efficacy	3.8	.82	.36*	.29*	.08*	.31*	-		
6. Secondary Risk Severity	2.5	.93	-.69*	-.14*	-.17*	-.40*	-.37*	-	
7. Secondary Risk Susceptibility	3.0	.73	-.47*	-.01*	.01*	-.24*	-.20*	.66*	-

* $p < .05$

A hierarchical multiple regression analysis obtained by performing bootstrapping was run to predict the strength of the relationship between the factors of the PMT, SRT and young adults' Covid-19 vaccine intention. The first regression model with the factors of the PMT was significant. All constructs of the PMT added statistically significantly to the prediction (see *Table 8*).

The hierarchical multiple regression analysis further showed a significant relationship between the regression model of the SRT and young adults' willingness to get vaccinated against Covid-19. When looking at the change in R^2, the SRT explained an additional 24.7% of young adults' Covid-19 vaccine intention compared to the PMT. Thus, the SRT gives an improved prediction of young adults' willingness to get vaccinated against Covid-19. As can be seen in *Table 8*, primary risk susceptibility, self-efficacy and secondary risk susceptibility were not significantly related to vaccine intention. On the other hand, primary risk severity, response efficacy and secondary risk severity were all associated with young adults' willingness to get vaccinated against Covid-19 ($p \leq .001$). When using only the item with the highest correlation ("Once I get invited, it would be easy for me to schedule a Covid-19 vaccination appointment if I wanted to") as a measurement of self-efficacy in the hierarchical multiple regression analysis, the results showed a significant correlation (see *Appendix D*).

Table 8

Association of the Factors of the Protection Motivation Theory and Secondary Risk Theory With Young Adults' Vaccine Intention

Model	*B*	95% CI[a]		*ß*	*t*	*p*
		LL[b]	*UL*[c]			
Protection Motivation Theory[d]						
Primary Risk Severity	.23	.05	.40	.17	2.6	.01
Primary Risk Susceptibility	.17	.00	.33	.13	2.0	.04
Response Efficacy	.56	.377	.75	.36	5.9	≤.001
Self-Efficacy	.23	.08	.39	.19	2.9	.004
Secondary Risk Theory[e]						
Primary Risk Severity	.24	.10	.38	.18	3.4	≤.001
Primary Risk Susceptibility	.08	-.05	.22	.06	1.2	.22
Response Efficacy	.30	.14	.46	.19	3.7	≤.001
Self-Efficacy	.04	-.09	.18	.03	.64	.53
Secondary Risk Severity	-.58	-.73	-.42	-.52	-7.4	≤.001
Secondary Risk Susceptibility	-.11	-.29	.07	-.08	-1.2	.24

[a] CI = Confidence Interval, [b] LL = Lower Level, [c] UL = Upper Level

[d] $F(4, 208)=23.0$, $p \leq .05$, $R^2=.31$

[e] $F(6, 206)=42.7$, $p \leq .05$, $R^2=.55$, R^2 *Change*$=.25$, F for R^2 *Change*$=57.2$, p for R^2 *Change*$\leq .05$

Further comments on vaccine intention

Lastly, participants were offered to leave additional comments on the topic or survey (see *Appendix C* for all comments left by participants). A number of the comments concerned the wish to choose which Covid-19 vaccine to get. More specifically, participants were hesitant of the vaccine developed by AstraZeneca. For example, one participant said that "[…] AstraZeneca was first to be seen as a proper vaccine, now it's not. Especially people of young age are right to be concerned about the side effects of the vaccine […]" and another participant stressed that "the advantages and disadvantages of getting the covid vaccine depend very much on the type of vaccine". Besides the hesitancy of getting vaccinated with the vaccine of AstraZeneca, one person said that "I think in the long term it is good to get vaccinated but […] with the little knowledge and the changing opinions of the government it is maybe not the best way to get vaccinated right now".

Discussion

Findings

The aim of this study was to find possible predictors of young adults' willingness to get vaccinated against Covid-19. Since vaccinating against Covid-19 has only started in late 2020, the topic was still a relatively unexplored field. There was little knowledge about young adults' in specific, despite them being the age group least willing to get vaccinated against Covid-19. The main results showed that both the PMT and SRT can be used to explain Covid-19 vaccine intention, albeit the SRT is offering an improved prediction. Especially perceived severity of secondary risk factors, such as possible side effects of Covid-19 vaccines, were a strong predictor of vaccine intention. On the other hand, demographic factors were not associated with young adults' willingness to get vaccinated against Covid-19.

The results of the first research question "How high is the willingness of young adults to get vaccinated?" indicate that the general Covid-19 vaccine intention for young adults is high, with 85.4% of participants indicating that they intend to get a Covid-19 vaccine once they get invited to receive it. This is in line with the current development of an increased Covid-19 vaccine intention in the population. Whereas over 60% of Dutch adults aged 18 to 39 intended to get a Covid-19 vaccine in March, this number has risen to over 70% in May (Rijksoverheid, 2021). These growing numbers are promising, however, to ensure that herd immunity will indeed be reached, governments should continue to promote getting vaccinated to those individuals hesitant to get vaccinated against Covid-19, especially in countries that continue to have a low vaccine intention (Sallam, 2021). Moreover, future research could focus on factors influencing this increase in vaccine intention to better understand factors motivating individuals to get vaccinated. For example, countries have now introduced greater freedom to those individuals already vaccinated against Covid-19, such as allowing them to travel more easily (SchengenVisaInfo, 2021), which could be a possible reason for the growth in vaccine willingness.

Furthermore, despite most research indicating that males are more likely to be willing to get vaccinated against Covid-19 (Zintel et al., 2021), this study found no significant association between gender and Covid-19 vaccine intention. When Covid-19 vaccination first began, claims about Covid-19 vaccines negatively affecting the fertility of women were spread on social media (Schraer, 2021), which may have caused young women wishing to start a family in the future to be more hesitant about getting vaccinated against Covid-19. However, communication about these rumours have improved since then, with many doctors, government websites and newspapers demystifying the claims. This development could have increased young women's willingness to get vaccinated against Covid-19 when compared to

studies conducted earlier in time, however, more research is needed to confirm these changes in attitude.

The results of the fourth research question indicate that there is no association between young adults' nationality and Covid-19 vaccine intention. This is not in line with the previous findings of Lazarus et al. (2020), who have found that vaccine uptake varied between different nationalities. However, the participants of this study were mostly German or Dutch and only few participants had a non-European nationality. This could explain why the results of this study were not significant, since the willingness to get vaccinated against Covid-19 in both Germany and the Netherlands is high. As of June 2021, the Netherlands have an overall Covid-19 vaccine intention of 87% (Rijksoverheid, 2021), whereas Germany had a vaccine intention of 72.6% in May 2021 (Robert Koch Institut, 2021b). Thus, both countries are currently on their way of reaching herd immunity through vaccination, however, future research could focus on the difference between countries with differing vaccine intentions and possible causes of these trends and if this is also applicable to other health protective behaviours than vaccines against Covid-19.

Moreover, this study found no association between young adults' willingness to get vaccinated against Covid-19 and living with someone in the risk group of people who are at risk of developing severe symptoms upon Covid-19 infection. A possible explanation for this trend is that the number of individuals who have already received their Covid-19 vaccine is steadily increasing. Due to most European countries' prioritisation schedules, individuals in the risk group have received their invitation to get the vaccine shot first, with many already being vaccinated at least once (Rijksinstituut voor Volksgezondheid en Milieu, 2021). This development may have caused young adults living with someone in the risk group to be less worried about transmitting the disease to vulnerable others in their household.

The results of the sixth research question "To what degree is having an underlying health condition associated with young adults' willingness to get vaccinated against Covid-19?" showcased no association between having an underlying health condition and young adults' Covid-19 vaccine intention. Similarly, a study by Kelly et al. (2021) has found that out of those groups at an increased risk of developing severe symptoms upon Covid-19 infection, only individuals aged 65 and above were more willing to get vaccinated. These results are worrying, since those individuals in the risk group are especially vulnerable to the symptoms of the virus. However, since the reported average vaccine intention in this study was high and the number of individuals part of the risk group only made up 8.6% of the participants, it can be argued that no significant results were found due to the general high willingness to get

vaccinated against Covid-19 and the low number of individuals diagnosed with an underlying health condition. Still, future campaigns should be mindful of these findings.

Lastly, the strong negative correlation between secondary risk severity and young adults' Covid-19 vaccine intention indicates that the SRT is a better model to estimate young adults' willingness to get vaccinated against Covid-19 than the PMT alone. Whereas the PMT can account for 30.7% of the variance in vaccine intention, the SRT is accounting for 55.4%. This is in line with the findings by Cummings et al. (2020), who predicted that secondary threat appraisal is crucial in determining individuals' engagement in protective behaviour. These results imply that communication about the risk of possible side effects or worries about the safety of Covid-19 vaccines should be improved. This is supported by the previous finding of Antonopoulou et al. (2020), who reported that health messages targeting knowledge of Covid-19 vaccine safety are among the most successful in increasing the uptake of Covid-19 vaccines. Further support for this implication comes from Neumann-Böhme et al. (2020), who found that worries about the safety of Covid-19 vaccines predicted a reduced willingness to get vaccinated against Covid-19. Based on the findings of this study, governments and health care institutions wishing to increase Covid-19 vaccine uptake should facilitate clear communication about possible side effects of the vaccines. In a more generalised way, these results further suggest that perceived secondary threat may be crucial in determining other health protective behaviour. However, to understand the width and applicability of the novel SRT, more research is needed (Cummings et al., 2020). For example, future studies could focus on whether the SRT is also offering improved explanations for health protective behaviour that do not have possible severe negative side effects, such as exercising or eating healthy, when compared to the PMT.

Limitations and Practical Implications

As mentioned before, the SRT is a relatively new model and there has not been any research on the SRT and its association with Covid-19 vaccine intention before (Cummings et al., 2020). Since there were no validated scales available, this study constructed new scales to measure the constructs of the SRT. When looking at the reliability of each construct, the factors self-efficacy and secondary risk susceptibility are unreliable. Therefore, it has to be considered that the results will vary when more reliable constructs are used. For example, when using only the highest correlated item of self-efficacy with Covid-19 vaccine intention, the results showed a significant correlation (see *Appendix D*). Thus, it is suggested that future research should

construct new items to improve the scales, as well conduct a pilot study to test the reliability of each scale in advance.

In addition to this, a number of comments left by participants of this study implied that participants of this study were worried about which vaccine they would get, mostly mentioning hesitancy in regards to the vaccine of AstraZeneca (see *Appendix C*). Therefore, it is suggested that future research looking at predictors of young adults' willingness to get vaccinated against Covid-19 should distinguish between the different available vaccines to obtain more precise results, as each vaccine may be associated with differing levels of secondary threat in individuals. This information can in turn be used by governments or health care institutions to determine how risk communication influences individuals' behaviour. For example, when asked about their vaccine intention, only 37.8% of German citizens would certainly get the AstraZeneca vaccine, while 73.3% indicated that they would certainly get an mRNA vaccine (Robert Koch Institut, 2021b). This variance should not be ignored and instead, this study proposes that the factors behind these differences should be examined to reach more thorough conclusions about secondary threat perception in general. This information may then in turn be used for similar situations in the future to improve overall risk communication. For example, researching this phenomena could be helpful in determining factors of successful risk communication about health protective behaviour by governments or health care institutions in the future. This is in line with the comment of one participant regarding distrust in government, further implying that trust in government and health care facilities could play a role in vaccine intention. This assumption is supported by the findings of Lazarus et al. (2021), who have found that trust in government is strongly linked to Covid-19 vaccine intention. Therefore, the difference in how each vaccine is perceived and how this may be linked to risk communication by governments or health care institutions can be of interest for future situations similar to the outbreak of Covid-19 as it can provide essential information on how inconsistent information can cause distress or fear in the citizens of a country (Rzymski, Zeyland, Poniedziałek, Małecka & Wysocki, 2021; YouGov, 2021).

Moreover, participants of this study were mostly university students. Since several studies have found that individuals with lower education levels are less likely to be willing to get vaccinated against Covid-19 (Viswanath et al., 2021; Williams, Flowers, McLeod, Young & Rollins, 2020), future research should aim for a broader population of young adults to be able to make more precise predictions on young adults' Covid-19 vaccine intention. Hence, should be researched if these findings are also applicable to young adults of a more diverse sample. Nevertheless, the high willingness to get vaccinated of young adults in this study is a

promising finding since general vaccine hesitancy has been increasing in the past few years, for instance, there has been a rise in numbers of parents who do not want to get their children vaccinated in the past few years (Salmon, Dudley, Glanz & Omer, 2015). This in turn also raises the question whether the SRT can be used to explain health protective behaviour in other age groups, for example, Kempe et al. (2020) have found that concerns about vaccine safety is a leading factor for vaccine hesitancy in parents. Therefore, this study proposes that future studies should research whether the SRT can give further insight into factors influencing other health protective behaviour in differing age groups, such as vaccine hesitancy in parents.

Conclusion

In conclusion, the results of this study imply that greater emphasis should be put on communication about side effects of Covid-19 vaccines. This study has shown that young adults' Covid-19 vaccine willingness is significantly related to their perceived severity of Covid-19 vaccines, which could be the base for future campaigns wishing to increase vaccine uptake. Yet, this study has also found a high willingness to get vaccinated against Covid-19 in young adults, which is in line with recent findings of the Dutch and German governments. To reach better insight into this increase, future studies could focus on how developments, such as the introduction of a vaccine passport that allows for more liberty, may have influenced vaccine intention of young adults (SchengenVisaInfo, 2021).

Moreover, this study proposes that the SRT offers an improved explanation for young adults' willingness to get vaccinated against Covid-19 than the PMT. Since the SRT is a relatively new model (Cummings et al., 2021), more research is needed to confirm the results of this study, however, based on the findings of this study it is suggested that future research should put more emphasis on the influence of secondary threat on health protective behaviour. Secondary risk factors have been shown to influence health protective behaviour, for instance, worries about vaccine side effects are one of the main factors increasing vaccine hesitancy in parents (Kempe et al., 2020). Therefore, it should be further researched whether the SRT can also offer more precise results than the PMT for different age groups and additional health protective behaviour.

This study did not find associations between young adults' willingness to get vaccinated against Covid-19 and the demographic factors gender, nationality, living with someone in the risk group and having an underlying health condition. On the other hand, participants of this study have raised concerns about vaccine communication by governments and health care

institutions (see *Appendix C*). Therefore, future studies may research if trust in government and health care institutions can be associated with Covid-19 vaccine willingness of young adults.

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Appendix

Appendix A: Survey questionnaire

Predictions of the Willingness of Young Adults to get Vaccinated Against Covid-19

Start of Block: Informed consent

Q0 Consent Form for Participation in a Survey about Young Adults' Willingness to get Vaccinated Against Covid-19 University of Twente Description of the research and your participation You are invited to participate in a research study conducted by Sarah Esen. The aim of this research is to test and better understand predictors of young adults' willingness to get vaccinated against Covid-19. It will take you approximately 15 minutes to finish answering the survey. Your participation will involve answering the survey questions. I would also like to get some demographics of you, such as your age or gender. Please try to answer each question and/or statement honestly.
Risks and discomforts This survey is handling a sensitive topic. If the thought of answering questions about your attitude towards the Coronavirus and a possible Covid-19 vaccine makes you feel uncomfortable, you are welcome to close this survey now. If you should feel any type of discomfort during the survey, you may also discontinue it at any given time, or contact the researcher (s.n.esen@student.utwente.nl) or the Secretary of the Ethics Committee of the Faculty of Behavioural, Management and Social Sciences of the University of Twente (ethicscommittee-bms@utwente.nl) about your concerns. Potential benefits There are no known benefits to you that result from participating in this research.
Protection of confidentiality Your participation in this study is anonymous, as no personal identifying information is collected in the survey.
Voluntary participation Your participation in this research study is voluntary. You may choose not to participate, and you may withdraw your consent to participate at any time. You will not be penalised in any way should you decide not to participate or to withdraw from this study. You are allowed to withdraw the study at any time.

Contact information If you have any questions or concerns about this study, if any problems arise or if you have any questions or concerns about your rights as a research participant, please contact s.n.esen@student.utwente.nl at the University of Twente. Contact information for questions about your rights as a research participant If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher, please contact the Secretary of the Ethics Committee of the Faculty of Behavioural, Management and Social Sciences at the University of Twente through the following email address: ethicscommittee-bms@utwente.nl

Consent I confirm that I have read the consent informtation and decide to participate.

O I agree (1)

O I disagree (2)

Skip To: End of Survey If)Consent Form for Participation in a Survey about Young Adults' Willingness to get Vaccinated Agains = I disagree

Page Break

End of Block: Informed consent

Start of Block: Demographics

Q1 What is your gender?

- O Male (1)
- O Female (2)
- O Diverse (3)
- O Prefer not to say (4)

Q2 What is your age?

_____

Q3 What is your nationality?

- O Dutch (1)
- O German (2)
- O Other, namely: (3) _____

Q4 Where do you currently reside?

- O Netherlands (1)
- O Germany (2)
- O Other, namely: (3) _____

Q5 What best describes your current occupation?

- O Student (1)
- O Unemployed (2)
- O Working full-time (30 hours or more a week) (3)
- O Working part-time (less than 30 hours a week) (4)
- O Other, namely: (5) _____

Q6 What is your highest educational degree (obtained or currently studying)?

- O High School Degree (such as HAVO, VWO, Mittlere Reife, Abitur, European or International Baccalaureate) (1)
- O Bachelor's degree (2)
- O Master's degree (3)
- O PhD (4)
- O Other, namely: (5) _____

Q7 With how many adults (18 years or older) are you currently sharing a household?

_____

Q8 What best describes your current living circumstances?

O I live on my own (1)

O I live in a shared accommodation (e.g. student house) (2)

O I live with my mother/father (3)

O I live with my partner (4)

O Other, namely: (5) _____

End of Block: Demographics

Start of Block: Risk group contact

Q9
Individuals aged 70 years or older are especially at risk of developing severe symptoms upon Covid-19 infection. Adults (18 years or older) with certain conditions are also at a higher risk of developing severe symptoms upon Covid-19 infection. These conditions include, but are not limited to:
- Chronic respiratory disease - Heart disease - Chronic kidney disease - Liver disease - Weakened immune system - Diabetes - Very severe overweight Please answer the following questions about this risk group. Do you currently share a household with someone who is especially at risk of developing severe symptoms upon Covid-19 infection?

O Yes (1)

O No (2)

O Prefer not to say (3)

Q10 Are you yourself especially at risk of developing severe symptoms upon Covid-19 infection?

O Yes (1)

O No (2)

O Prefer not to say (3)

End of Block: Risk group contact

Start of Block: Covid-19 infection

Q11 Have you yourself been infected by Covid-19?

- O Yes (1)
- O No (2)
- O I don't know (3)
- O Prefer not to say (4)

End of Block: Covid-19 infection

Start of Block: Vaccine intention

Q12
Please answer the following statement about vaccine intention.

When I get invited to receive a Covid-19 vaccine, I will take it.

- O No, I certainly will not (1)
- O No, I probably will not (2)
- O I do not know (3)
- O Yes, I probably will (4)
- O Yes, I certainly will (5)

End of Block: Vaccine intention

Start of Block: SRT

Q13 Please indicate your agreement with the following statements about Covid-19 infection and Covid-19 vaccines.

	Completely disagree (1)	Disagree (2)	Neutral/no opinion (3)	Somewhat agree (4)	Completely agree (5)
I will be very sick if I get Covid-19. (1)	O	O	O	O	O
Covid-19 is no worse than the seasonal flu. (2)	O	O	O	O	O
I am concerned that people I know will get infected with Covid-19. (3)	O	O	O	O	O
I am concerned that I will infect others with Covid-19. (4)	O	O	O	O	O
I believe that I am at high risk of catching Covid-19 compared to others. (5)	O	O	O	O	O
I am safe from getting Covid-19. (6)	O	O	O	O	O
I am less likely than other people to get Covid-19. (7)	O	O	O	O	O
If I receive a Covid-19 vaccine, I will be protected against Covid-19. (8)	O	O	O	O	O
If I have a Covid-19 vaccine, I will not be able to spread Covid-19 to others. (9)	O	O	O	O	O

If I have a Covid-19 vaccine, I will not have to socially distance anymore to protect others from Covid-19. (10)	O	O	O	O	O
Getting a Covid-19 vaccine will help my country get back to normal. (11)	O	O	O	O	O
I feel in control as to whether I will have a Covid-19 vaccine. (12)	O	O	O	O	O
Once I get invited, it would be easy for me to schedule a Covid-19 vaccination appointment if I wanted to. (13)	O	O	O	O	O
I can choose if I want to be vaccinated against Covid-19. (14)	O	O	O	O	O
Side effects of Covid-19 vaccines are severe. (15)	O	O	O	O	O
I feel that getting a vaccine against Covid-19 is harmful for me. (16)	O	O	O	O	O
Covid-19 vaccination is safe. (17)	O	O	O	O	O

I worry about the unknown effects of vaccines against Covid-19. (18)	O	O	O	O	O
I am concerned about experiencing side effects from a Covid-19 vaccine. (19)	O	O	O	O	O
If I receive a Covid-19 vaccine, I am safe from getting its side effects. (20)	O	O	O	O	O
I am at a higher risk of getting side effects from a Covid-19 vaccine compared to others. (21)	O	O	O	O	O

End of Block: SRT

Start of Block: Other comments

Q14 Do you have any other comments about Covid-19 vaccination?

_____

_____

_____

_____

_____

End of Block: Other comments

Appendix B: Mean Scores for the Items of the SRT

	Mean	*SD*	*N*
Please answer the following statement about vaccine intention.	4.34	1.042	213
When I get invited to receive a Covid-19 vaccine, I will take it.			
I will be very sick if I get Covid-19.	3.09	1.077	213
I am concerned that people I know will get infected with Covid-19.	4.31	.904	213
I am concerned that I will infect others with Covid-19.	4.25	.966	213
I believe that I am at high risk of catching Covid-19 compared to others.	2.31	.959	213
I am safe from getting Covid-19.	4.00	1.005	213
I am less likely than other people to get Covid-19.	3.66	1.081	213
If I receive a Covid-19 vaccine, I will be protected against Covid-19.	3.66	.941	213
If I have a Covid-19 vaccine, I will not be able to spread Covid-19 to others.	2.76	1.096	213
If I have a Covid-19 vaccine, I will not have to socially distance anymore to protect others from Covid-19.	2.21	.955	213
Getting a Covid-19 vaccine will help my country get back to normal.	4.21	.940	213
I feel in control as to whether I will have a Covid-19 vaccine.	3.28	1.223	213
Once I get invited, it would be easy for me to schedule a Covid-19 vaccination appointment if I wanted to.	3.94	1.058	213
I can choose if I want to be vaccinated against Covid-19.	4.03	1.092	213
Side effects of Covid-19 vaccines are severe.	2.68	1.025	213
I feel that getting a vaccine against Covid-19 is harmful for me.	2.08	1.083	213
Covid-19 vaccination is safe.	2.29	1.059	213
I worry about the unknown effects of vaccines against Covid-19.	3.01	1.308	213
I am concerned about experiencing side effects from a Covid-19 vaccine.	2.99	1.215	213

	Mean	*SD*	*N*
If I receive a Covid-19 vaccine, I am safe from getting its side effects.	3.86	.929	213
I am at a higher risk of getting side effects from a Covid-19 vaccine compared to others.	2.07	.939	213

a. Some or all bootstrap sample results are missing, so no bootstrap estimation has been performed for this table.

Appendix C: Comments Left by Participants

Do you have any other comments about Covid-19 vaccination?
As long as it prevents death and severe symptoms, it is worth getting vaccined despite the potential side-effects
As you can see from the news, whether they are valid or not, AstraZeneca was first to be seen as a proper vaccine, now it‘s not. Especially people of young age are right to be concerned about the side effects of the vaccine, since they are less likely to die from Covid, but more likely to have severe side-effects from the vaccine. This is one of the reasons, why I am still not accepting the fact that I should get the vaccine. It only protects me, not my dad. I hereby totally risk that I could die from covid, sure, but since I am young I will probably survive. My dad however not. So for me, the vaccine makes sense for my dad, not for me tho.
Everyone must do his best in order to go back to normal and save other people’s lives. I’ve received many vaccine in my short life, if I have to receive another one I’m ok with that. I just hope that everybody feels the same.
Hurry up I want my vaccine dose
I am a little bit afraid of getting the vaccination but only because of my fear of needles.
I am confident that the science behind it is trustworthy. I am also confident that the authorization of dutch specialists to approve the vaccine is trustworthy.
I dont think im at risk. It has not been proven for many yet that it will prevent spreading (although I think it is likely). But the main reason for me to get the vaccin is that I want my life back and this is apparently not gonna happen without a vaccin.
I feel like there are quite big differences between the different vaccines. Greetings from Amsterdam! :)
I just want it to be able to do stuff again, personally I’m not even that worried about getting Covid
I might personally have concerns about the new types of Corona and if the vaccines against them still work
I think in the long term it is good to get vaccinated but know with the little knowledge and the changing opinions of the government it is maybe not the best way to get vaccinated right now.
I think which vaccination I would receive would also be important for me (e.g. preferring Biontech over AstraZeneca).
I took an offer for a vacine through my current internship and I am looking forward to it. But I would have liked to get a different kind.
I want one as soon as possible
I want to get vaccinated as soon as possible!
I will be happy to take it as soon as it is offered to me! I believe there are huge benefits both in terms of personal health and society over all which dramatically outweigh any risk.

Do you have any other comments about Covid-19 vaccination?
I will probably get the vaccination because I suffer from heart disease and I rather have pain in my arm or feel dizzy for two days, but I am not sure about the long term side effects. Additionally, the risk of getting thrombosis combined with birth control scares me a bit. All in all, I do not feel completely safe getting the vaccination.
I wish some people understood statistics better.
I wish we could choose which vaccine we receive
I'm a bit concerned since I heard about the side effects of the AstraZeneca vaccine but I'm one of the last groups to get vaccinated so I think we will have a better idea of the safety of the vaccine by then.
If given the opportunity, I would immediately get a vaccine mainly in order to protect the more vulnerable high risk people in our society
in fact, for me, whether I will take the vaccine dependent on what kind of the vaccine is, I will only take the vaccine with transparency report and data about the side effect and experiment result.
Ist absolut safe... nur schneller impfen wäre geiler
It has only been researched for about a year. Other vaccinations have been tested for at least five years, often longer in order to research the possible side and long-term effects. After a year, ca. 2.000.000 people died due to corona, with over 100.000.000 infections. This is a death rate of 2%. In contrast, every year 2.000.000 children die from starvation and another 2.000.000 people die from the consequences of obesity in western countries. Meaning that 4.000.000 people die because of the unbalanced disribution of food. And now, billions of euros are invested into a vaccine, which hopefully does not have any severe side effects, but we do not know that. Additionally it is a vaccination that changes the DNA, so even more uncertainty is there as this is very new. Logically this would lead to longer research but it does not. I think, that the money that is now invested in order to protect people from a virus that is harmless for 80% of the people, could be invested in a more senseful way.
It is a little bit scary when you hear people in the news who have side effects of the vaccination
It will not only help me, but the whole world
It would be great if people could choose to get vaccinated, but not with the astrazeneca vaccine. My mom for example works with the elderly, and she cannot choose this.
Long-term health effect of the vaccine have not been studied, especially among older people that are more vulnerable to both Covid-19 and the vaccination side effects.
No, I just do not want to get one
One year ago I had ablation for a heart rhythm disorder : ventricular tachycardia. I get palpitations sooner when having fever, when I didn't drink enough, when temperatures are >30 degrees, drink coffee etc. I am somewhat concerned of getting the rhythm disorder back when I will develop symptoms such as fever from either covid or the vaccin. However de rhythm disorder never returned after cardiac ablation.
please go vaccinate

Do you have any other comments about Covid-19 vaccination?
Side effects can be experienced with every vaccine (or any substance, which our immune system makes contact with, even those safe ones for majority), people also can die from getting it. The fear of covid vaccine is greater, because its usage is followed by media constantly and because we try to vaccinate whole population, so of course more people experience side effects, because more people are getting vaccine in the first place. Thinking that I can do what I want after getting vaccinated is pure irresponsibility, because no vaccine works in 100% cases and getting vaccinated does not mean we cannot harm others (even by infecting someone with flu, which lowers their immunity and they catch covid more easily).
The advantages and disadvantages of getting the covid vaccine depend very much on the type of vaccine. The immunization rate and possible side effects highly vary. I would like to have the freedom to choose which specific vaccine to get.
The upsides of taking the vaccines are much bigger for me compared to the possible side effects of the vaccine.
The vaccination is completely safe and if it wasn't good for you it wasn't approved by the eu
There are multiple vaccines from different pharmacutical companies and it has been proven that there is a difference in various factors including side effects. I think they shouldn't by combined as if there is only the one vaccine. Maybe my opinions about one vaccine is different from the other brand.
There are side effects for everything in our world.
There is not enough
Vaccination should not be the only solution to this problem
We don’t have enough hindsight to know what will be the short term and long term effects of the vaccine but it seems to be the solution to get out of this crisis.
We don’t know enough about the vaccine to be scared or to be completely safe. Information is missing for me to be concerned.
We need a mass vaccination to live normal again :)
when I have the option I definitely want to get a vaccination.
While it is very likely that I will experience momentary discomfort by being vaccinated, I do believe the consequences of not getting vaccinated would be much more severe, both for myself and the people I come in frequent contact with.

Appendix D: Hierarchal Multiple Regression Analysis with only Reliable Items of Self-Efficacy and Secondary Risk Susceptibility

Coefficients[a]

Model		*Unstandardized Coefficients*		*Standardized Coefficients*		*Sig.*
		B	*Std. Error*	*Beta*	*t*	
1	(Constant)	.202	.428	.637	.472	.637
	Primary Risk Severity	.237	.083	.005	2.842	.005
	Primary Risk Susceptibility	.135	.080	.091	1.696	.091
	Response Efficacy	.539	.091	.000	5.897	.000
	Once I get invited, it would be easy for me to schedule a Covid-19 vaccination appointment if I wanted to.	.264	.059	.000	4.485	.000
2	(Constant)	3.334	.473	.000	7.047	.000
	Primary Risk Severity	.230	.068	.001	3.369	.001
	Primary Risk Susceptibility	.070	.066	.285	1.071	.285
	Response Efficacy	.289	.080	.000	3.628	.000
	Once I get invited, it would be easy for me to schedule a Covid-19 vaccination appointment if I wanted to.	.129	.050	.010	2.587	.010
	Secondary Risk Severity	-.526	.085	.000	-6.203	.000
	I am concerned about experiencing side effects from a Covid-19 vaccine.	-.077	.058	.190	-1.314	.190

a. Dependent Variable: Please answer the following statement about vaccine intention.

When I get invited to receive a Covid-19 vaccine, I will take it.