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Author:
Minas Birihane

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(signature author)

Course coordinator:

Eirik Bjorkheim Abrehamsen

Supervisor(s):

Willy Solbery Røed

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Master Thesis

Exploring the perception of Covid-19 vaccine benefit/risk, with a focus on a specific context (e.g., Norway)

Minas Birihane

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Abstract

This study aims to identify the patterns that influence the risk perception of the COVID-19 vaccine uptake. Secondly, to explore the main factors influencing the COVID-19 vaccine uptake in Norway. Lastly, to provide recommendations on influencing vaccine uptake to improve the mass immunization program for future pandemics. An online questionnaire is applied as a research tool to collect data. Data from 150 respondents is apprehended, and the data is further analyzed using statistical analysis software (SPSS and R). Both descriptive and multiple logistics regression analysis is used to analyze variables and the significance of their relations to other independent variables. The research found that the main influencing factor of COVID-19 vaccine acceptance is the recommendations from the authorities and the ministry of health (34.00%), followed by vaccine effectiveness (28.67%), fear of adverse side effects (20.67%), and increased of positive COVID-19 cases (16.67%). In addition, the Statistical analysis found that variables such as gender, age groups, education level, location, and ethnicity significantly influence the risk perception of COVID-19 vaccine acceptance.

Acknowledgements

I would like to thank Professor Willy Solberg Røed for his support and providing me the opportunity to conduct this thesis and improve my knowledge and understanding of risk perception. I am thankful to Jonathan Muringani and my class mates for their feedback and editing help. Appreciation is also due to my family and friends who supported and motivated me in to complete this thesis.

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1 Introduction

The SARS-COV-2 (COVID-19) outbreak has revolutionized everything in the world, and the consequences are assumed to continue for years to come (de Palma et al., 2022). Measures such as better hand hygiene and washing, quarantine, and strict limits such as mask-wearing and vaccination have been adopted to prevent the spread of COVID-19 (de Palma et al., 2022). Though prevention methods of conceiving the COVID-19 virus have been promoted, it is necessary to understand individuals' perception of the virus' threat (Saadat et al., 2020). Participating in or abstaining from taking the COVID-19 vaccine may be influenced by attitudes and beliefs about the risks. Individuals take more preventative steps when perceiving a more significant risk; the reverse is true when perceiving a lower risk (Sinclair & Agerström, 2021). COVID-19 vaccine development commenced in January 2020 and has been advancing rapidly (Shahcheraghi et al., 2021). According to (Shahcheraghi et al., 2021), there were 115 vaccine candidates in different development and testing areas as of April 2020. Because of the high protective restrictions and limited treatment options for the COVID-19 pandemic, a combination of preventive measures and mass vaccination will be necessary to limit its spread. Moreover, COVID-19 vaccinations must be widely accessible and broadly recognized to lessen the hazards related to the condition (Shahcheraghi et al., 2021). Vaccines have received many varied views and attitudes, which could lead to a delay or outright refusal (Andreadakis et al., 2020). Vaccination hesitance is challenging to predict on many occasions because the individuals' opinions consider the efficiency, safety, and the subjected risk groups (Sinclair & Agerström, 2021).

Following the study made by World Health Organization (WHO), vaccine absorption barriers may vary depending on the circumstances. Moreover, While developing a national COVID-19 response plan, it is critical to understand the variables that impact vaccination acceptance or resistance (Puri et al., 2020). As a result of widespread vaccination perception, vaccine uptake and effectiveness may both suffer (Organization et al., 2020b). Vaccine hesitancy, according to the World (WHO), has been identified as a serious concern for global health in 2019, a condition that could result in low vaccination coverage and the spread of the SARS-COV-2 virus in the future as a result of decreasing confidence in Measles, mumps and rubella (MMR) immunizations (WHO, n.d.-b). As long as a sufficient number of people decline the COVID-19

vaccination, broad individual immunity is unlikely to result in herd immunity (Cohen, n.d.). In light of the emergence of new strains of SARS, there is growing concern about the disease, and current research (WHO, n.d.-a) suggests that immunization and earlier illness may not be adequate to safeguard against future infections. According to WHO, n.d.-a, developing mass immunity against CoV-2 in all patients appears to be far more challenging than previously anticipated (WHO, n.d.-a).

Booster doses of COVID-19 have been shown to reduce the risk of diseases and hospitalizations, making it vital to emphasize the importance of immunization against COVID-19 (Chenchula et al., 2022). Otherwise, mass hospitalizations can overwhelm the healthcare system (Massonnaud et al., 2022). COVID-19 vaccine had been administered to more than 710 million people globally by April 2021; by February 2022, approximately 63% of the global population was vaccinated at least once (Ioannidis, 2022; Mathieu et al., 2021). However, after immunization rates peaked in mid-April 2021, vaccine uptake seems to have declined, perhaps due to an increase in vaccine hesitancy (Rosen et al., 2021). In addition, it shows that when a person infected with COVID-19 who already suffers from chronic health problems dramatically raises the risk of severe illness (Gao et al., 2020). For example, people who live in rural areas in China are more likely than those who live in urban areas to be obese, diabetic, and hypertensive. Moreover, patients with high blood pressure or diabetes are more prone to contracting potentially lethal COVID-19 infections (Wang et al., 2007).

Studies (Anderson et al., 2020; Thomas, 2021) show that obesity is closely associated with the severity of COVID-19 infection. Moreover, the COVID-19 infection severity of patients older than 65 shows little to no association with their obesity (Anderson et al., 2020; Thomas, 2021). Their research (CFR, n.d.) discovered that people considering COVID-19 a severe disorder are more likely to seek vaccination. According to several studies that have looked at this topic, concerns regarding the speed with which vaccines are administered and the use of novel technologies (such as mRNA vaccination) may have contributed to the notion that vaccinations are more harmful than they used to be (CFR, n.d.). In addition, it has been argued that people's confidence in health professionals may cause them to have a more negative perception of the risks associated with vaccines when they see advertising materials for them. Many critical issues remain unanswered due to these incremental steps forward in knowledge and understanding (Li

et al., 2021).

Evidence (Kraft et al., 2022) shows that the risk perception about COVID-19 vaccine hesitance differs across different demographic groups. Vaccination aversion to the COVID-19 vaccine is more common in urban areas than in rural ones, which may result in the pandemic having a longer-lasting impact in these locations (Mann et al., 2022). Therefore first and foremost, it is critical to discover whether or if the COVID-19 immunization is acceptable to urban city residents before moving forward with the experiment. According to the Norwegian Institute of Public Health (FHI) weekly report, foreigners with foreign-born parents have less acceptance towards receiving the vaccine than Norwegians with Norwegian-born parents (Kraft et al., 2022). In the early phases of the COVID-19 pandemic, the vaccination hesitancy among the immigrant groups in Norway was due to a lack of enough information and fear of the side effects. According to (FHI), in the autumn of 2020, among the high-risk communities, immigrant groups from East Europe have the lowest acceptance rate (40%) for taking the vaccine, followed by immigrant groups from Africa (55%) and West Asia (Middle East, Turkey, Pakistan) (57%).

Data gathered by (Nilsen et al., 2021) shows that the vaccine acceptance rate increased among the immigrant groups from East Europe from 40% to 57%, and the overall acceptance rate among all immigrant groups increased from 70% to 84%. It may be explained by individuals' concern about sickness, including obesity and heart conditions, and their belief in the benefits of vaccinations (Nilsen et al., 2021). On the other hand, a general lack of confidence in COVID-19 vaccinations or the provider may be produced by early errors in vaccine communication and delayed earlier immunization (Odone et al., 2020).

1.1 Background of the study

Coronavirus disease has significantly impacted how people work, study, and live their lives today. Due to the fast spread of the pandemic, all commercial activities were suspended temporarily. Although COVID-19 incidents have generated much data to combat public health incidents, it may be worthwhile to analyze the enormous volumes of data to gain valuable insight into the issue, even if one statistic cannot reveal all of the information (Jia et al., 2020). Confirmed cases worldwide as of June 2022 are assumed to be more than 540 million cases and 6.3 million deaths, but the actual number of cases may be way higher than that. Figure 1 depicts the distribution of COVID-19 infection cases by country of origin (bloomberg, n.d.).

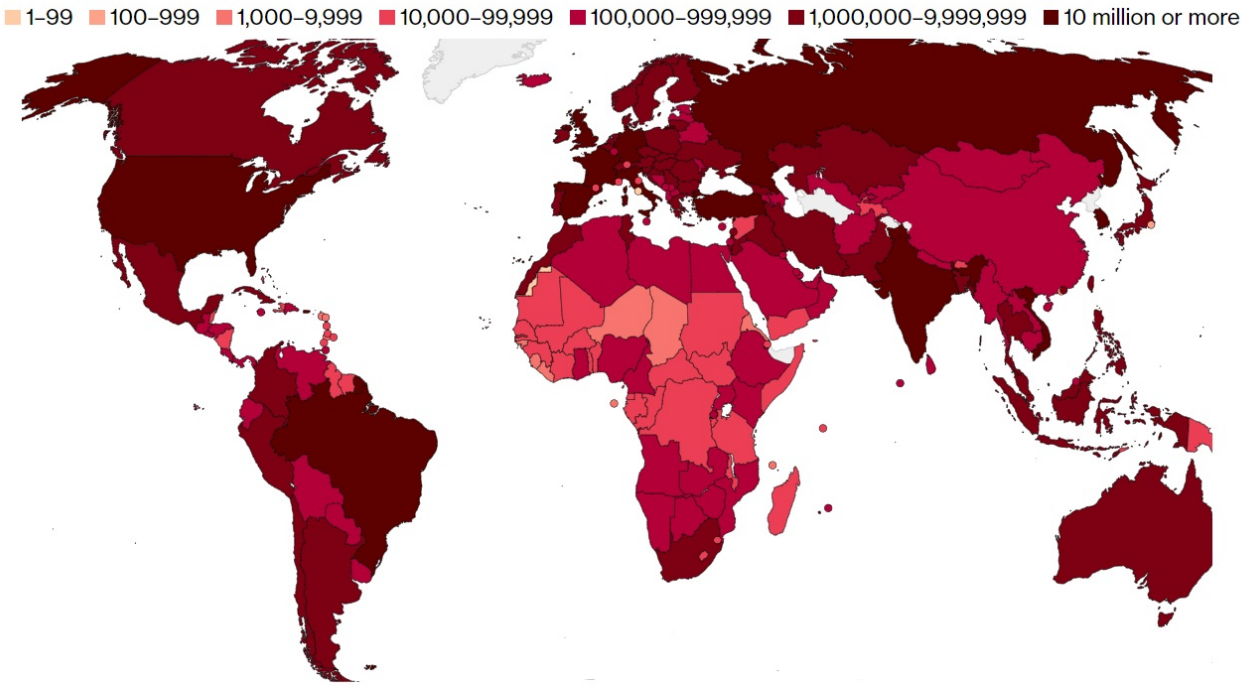

Figure 1: total number of cases as of june 2022 (bloomberg, n.d.).

Although vaccine manufacturing is recognized as a significant scientific triumph in the promotion of global health, vaccination programs may lessen the burden of infectious diseases, reduce mortality, and enhance the overall performance of healthcare systems. However, as seen by the issue of vaccine hesitancy, the advantages of vaccination can only be realized if individuals are ready to accept or reject vaccines, as opposed to the opposite (2. WHO, n.d.). The World Health Organization (WHO) has announced its plans for 2019, and vaccine hesitancy is one of the world's top ten health concerns. Understanding the psychological and sociodemographic factors contributing to this hesitation is a critical priority in the fight against it (WHO, n.d.-b).

The current epidemic has also shown the public's reliance on effective vaccination, with the rate at which a pandemic spreads directly proportional to the general public's availability and widespread use of vaccines, as demonstrated by the current epidemic (WHO, n.d.-b). Mass vaccination programs are also heavily reliant on low vaccine hesitancy, which is becoming a growing source of concern in the context of emerging infectious diseases and is further considered a significant threat to the successful roll-out of vaccines during the current and upcoming pandemics (WHO, n.d.-b).

Research (CFR, n.d.) on vaccine-reluctant individuals has revealed some criteria that define those reluctant to receive COVID-19 immunizations. In their research (CFR, n.d.), they discovered that people who consider COVID-19 to be a severe disorder are more likely to seek vaccination. According to (CFR, n.d.), concerns regarding the speed with which vaccines were created and the use of novel technologies (such as mRNA vaccination) may have contributed to the notion that vaccinations are more harmful than they seem to be. In addition, it has been argued that people's confidence in health professionals may cause them to have a more negative perception of the risks associated with vaccines when they see advertising materials for them. Many critical issues remain unanswered due to these incremental steps forward in knowledge and understanding (Li et al., 2021).

1.2 Research Significance

A lot of noteworthy contributions are made in this work. The implications of this thesis suggest that several factors, such as demographic factors, health status, and social media, can influence the risk perception of the COVID-19 vaccine uptake among Norway's residents. Furthermore, due to false information surrounding the vaccine on social media, the policy implications suggest that there is also a need for effective and transparent communication between the Norwegian authorities and the general public.

1.3 Statement of the problem

Recent research considering young people (Sinclair & Agerström, 2021) and active social media users (Fieselmann et al., 2022) on vaccine-reluctant individuals has revealed some criteria that define those reluctant to receive COVID-19 immunizations. Following the ideas put out to explain vaccine aversion, a wide range of cognitive (Acar-Burkay & Cristian, 2022), and social (Wilson & Wiysonge, 2020) variables have been linked to it. In addition, fear of side effects and health-related anxieties, as well as confirmation biases, may influence how people perceive the risk of vaccine acceptance in their own lives (Wilson & Wiysonge, 2020). For several reasons, including skepticism about the legitimacy of scientific findings, a lack of confidence in the government or healthcare professionals, and the increasing availability of terrible personal experiences on social media platforms, people may be hesitant to get vaccinated (Wilson & Wiysonge, 2020). Moreover, considering the link between other protective behaviors, such as social distance and cleaning practices, it is critical to investigate the connection between general adherence to pandemic mitigation measures and vaccination intention. Another element that is likely to be relevant is the source of information obtained about vaccinations and the pandemic (Li et al., 2021). According to (Li et al., 2021), social media platforms are more biased than other information sources in favor of erroneous, misleading, and conspiratorial information about the COVID-19 vaccines, owing to the worldwide availability of news on social media platforms. This research aims to objectively investigate the relationship between vaccination hesitancy and these theoretical attributes to determine their relative relevance while controlling for all other circumstances.

1.4 Statement of the objectives

1.4.1 General objectives

To explore the perception of risk for COVID-19 Vaccine among Norway's residents

1.4.2 Specific objectives

- To describe the pattern of perception of risk for COVID-19 among Norway's residents
- To understand the factors that influence perception of risk for COVID-19 among Norway's residents
- To make recommendations to influence vaccine uptake on the current COVID-19 and future pandemics

1.5 Limitations

Considering the limitations, this study is not representative for the whole population of Norway. A properly conducted random sampling of a larger population can provide a more representative results. Another potential factor that influences this study's results is that it may be appealed to younger, highly educated and high income (more than 300 000 NOK/YR) respondents. Moreover, other groups that could have significantly contributed to this study might have been underrepresented.

2 Literature Review and Theory

2.1 Covid-19 Vaccine program in Norway

The Norwegian Medicines Agency must authorize the vaccine before it can be included in the Norwegian Immunization Program (NIPH, n.d.). After receiving approval from the European Medicines Agency (EMA), COVID-19 vaccines may be used in Norway after their introduction into the country. Before their COVID-19 vaccine can be licensed, vaccine manufacturers must submit their results to the European Medicines Agency for a "rolling review" (NIPH, n.d.). A recommendation will be made by the EMA, and the Norway Commission will then provide permission for its usage across Europe (EU Commission). Under the terms of Norway's accession to the European Economic Area (EEA), its government has agreed to employ the COVID-19 vaccine developed by the European Commission as part of its immunization program (NIPH, n.d.). The Norwegian Institute of Public Health (NIPH) has approved using the Pfizer/BioNTech COVID-19 vaccine for vaccination of priority groups such as the elderly in nursing homes throughout Norway and those who are more susceptible due to other illnesses (Mills & Salisbury, 2021). Pfizer and BioNTech developed the vaccine (Belete, 2020). The Norwegian government's Coronavirus Immunization Program uses COVID-19 vaccines from Pfizer/BioNTech, Moderna, and Oxford/AstraZeneca, which are now available on the market. The program uses three vaccinations, each of which must be administered twice to be successful. In February 2020, Johnson & Johnson submitted a vaccine candidate for the COVID virus evaluation to the (EMA) (Agency, n.d.).

Figure 2 shows the daily number of reported COVID-19 cases in Norway from February 2020 to July 2022, and the green line shows the cumulative cases since the outbreak. Highest number of reported cases shows to be on the 7.Feb.2022 with 24.479 confirmed cases (FHI, n.d.-d).

The development of vaccinations might be considered to be an influential scientific achievement in the promotion of improvements in global health. There is a possibility that vaccination programs could benefit the health care system in general (Mejia et al., 2020). The COVID-19 virus spreads through airborne particles that come out through the nose or mouth due

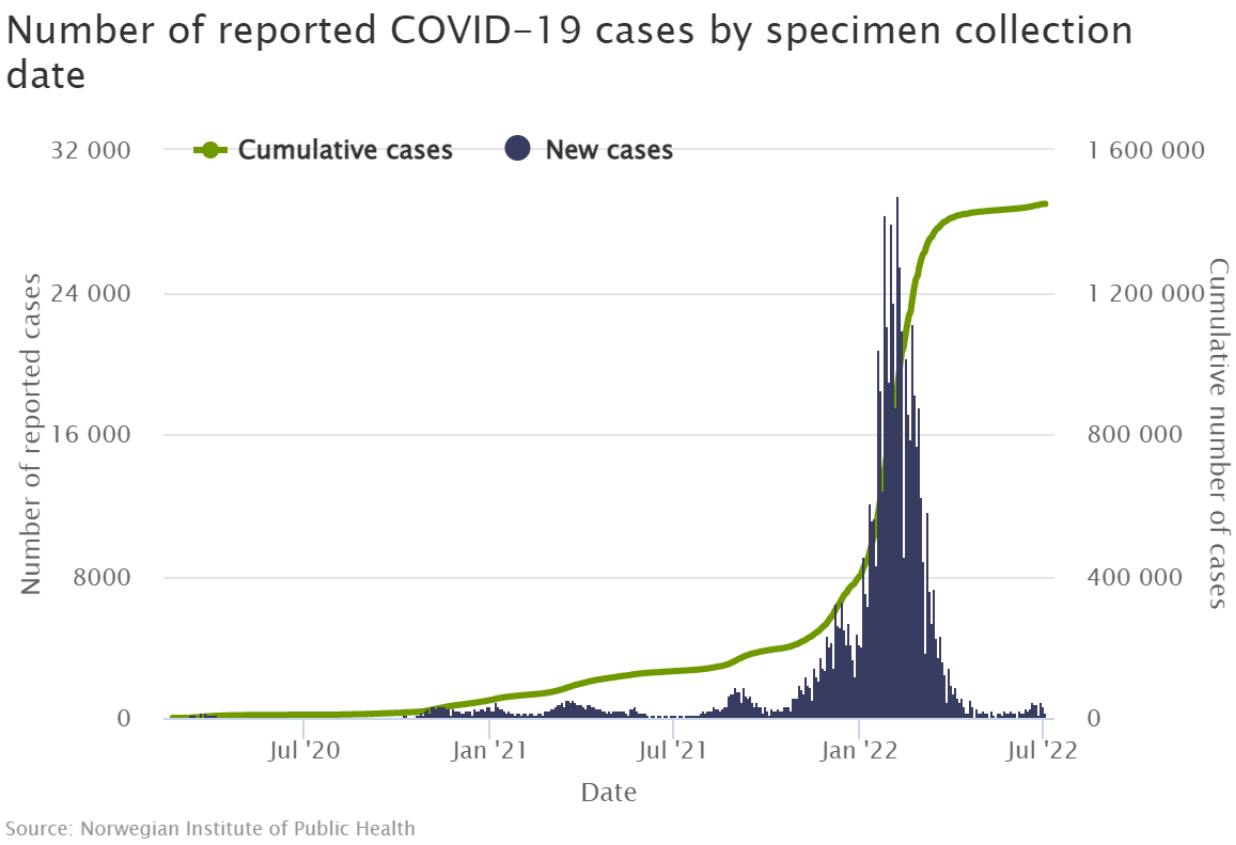

Figure 2: Number of reported cases in Norway, Feb 2020 - July 2022 (FHI, n.d.-d).

to coughing and sneezing, and it also transmits through ventilation or by touching the eyes or mouth after touching an infected surface, making it rapidly spread across the population (Organization et al., 2020a). Scientists were diligently and quickly developing vaccines against COVID-19 throughout the world during the time this study but only few were approved for vaccination in Norway. As of July 2022, the five vaccines that were approved in Norway are, Novavax, Moderna, Pfizer/BionThech, Janssen (Johnson & Johnson), and Valneva (Tracker, n.d.). After the approval of these vaccines, there were some supply chain and distribution challenges due to the need of a reliable cold storage, other factors such as the service and environmental influence during transport also showed a significant influence in the COVID-19 vaccine distribution rate and the employment of innovative technologies (Sun et al., 2021). When exposed to promotional materials for vaccinations, those with a high level of trust in the medical community may develop a greater degree of skepticism over the dangers presented by vaccines (Sun et al., 2021).

According to FHI, by the end of 2021, there were 41 death incidents in Norway, related to COVID-19 vaccination, where 19 cases were individuals who initially suffered from chronic

deceases such as heart, lung, and cancer diseases (FHI, n.d.-e). Vaxzevria (AstraZeneca) was used as a COVID-19 vaccine in Norway from February 2021 to March 2021 due to several adverse side effects and death reports in Europe. There were around 135 000 (AstraZeneca) vaccines provided to health care workers. Furthermore, FHI recommended mRNA vaccine as the second dose for those who received AstraZeneca as a first dose (FHI, n.d.-b).

The challenge of vaccination fear demonstrates that for people to gain the benefits of vaccination, they must first be ready to accept or reject vaccinations. According to (WHO), developing a better understanding of the psychological and sociodemographic factors that lead to vaccine hesitancy is one of the most important steps towards overcoming it. People's dependence on really effective vaccinations has been shown again by the present pandemic. A pandemic's progression depends on the availability of vaccines and their use by the general population (WHO, n.d.-b). The ongoing COVID-19 epidemic has shown that this is indeed the case. This virus is a growing concern in the context of novel infectious diseases and a significant threat to effective vaccination during current pandemics and those yet to come. Successful mass vaccination programs are dependent, to a significant degree, on just a small amount of vaccine resistance is becoming an increasing challenge in the context of the rise of infectious diseases (Wollebæk et al., 2022). Vaccine hesitancy can be viewed in several factors, such as personal safety, where individuals refuse to take the vaccine despite having enough information and assurance. Another aspect can be classified as personal protest due to political beliefs and personal negative attitudes towards the vaccine. Furthermore, those who view COVID-19 as a severe disease are more accepting of vaccination (Wollebæk et al., 2022).

Various factors have been hypothesized to influence vaccination hesitancy, including cognitive, social, and political factors (Acar-Burkay & Cristian, 2022; Wilson & Wiysonge, 2020). Pre-existing notions about the safety and efficiency of vaccination might influence people's perceptions of vaccine risks. Concerns about one's health and possible adverse consequences are also contributing factors. These factors include skepticism about scientific results, a lack of trust in government or medical professionals, and the visibility of bad personal experiences on social media (Ebrahimi et al., 2021). According to a study performed during the initial outbreak, further research is required to determine if there is a correlation between adherence to pandemic mitigation measures and a desire to get vaccinated against the disease when con-

sidering other protective behaviors like social distance and cleaning standards. It is also likely that the origin of the knowledge about vaccinations and the pandemic will be critical (Zickfeld et al., 2020). The study shows that 95% of the participants used the reported news media and 63% used social media platforms as a source of information (Zickfeld et al., 2020). Social media platforms are more likely used as other sources of information to spread false, misleading, and conspiratorial information surrounding the COVID-19 vaccines. In addition, through various social media platforms, information can be quickly disseminated. In the context of vaccination hesitancy, these theoretical characteristics will be investigated (Zickfeld et al., 2020). As a result, the relative influence of each of these characteristics while simultaneously controlling for the other factors involved can be determined. A lack of willingness to vaccinate can severely affect the general public's health during the current epidemic and future pandemics (Zickfeld et al., 2020).

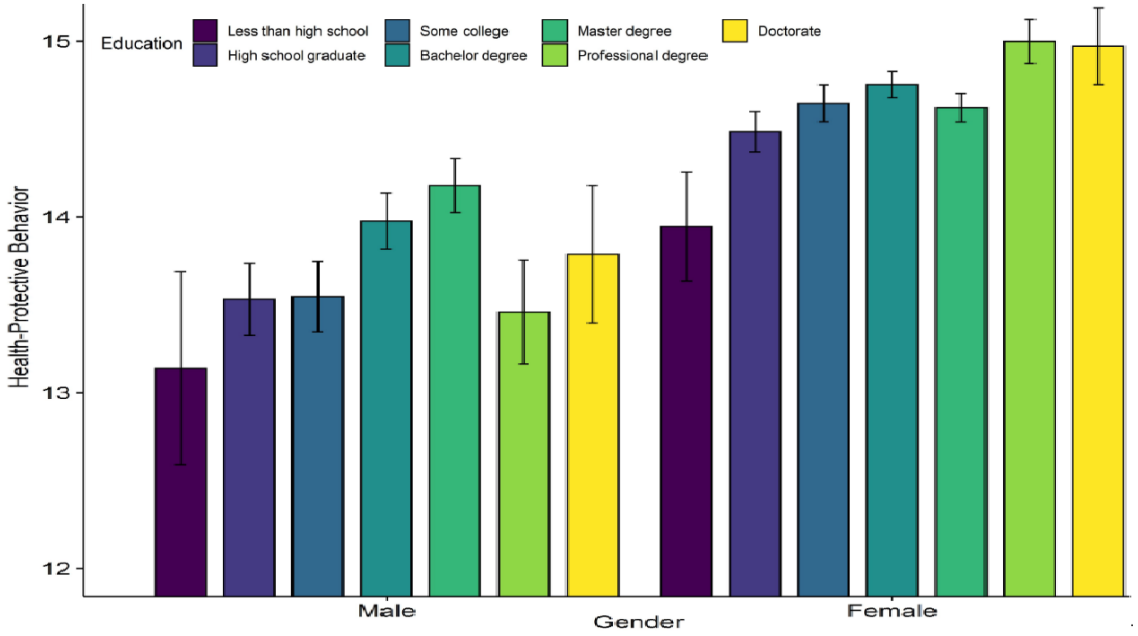

Figure 3: Health protective measures (x-axes) vs Gender (y-axes) (Zickfeld et al., 2020).

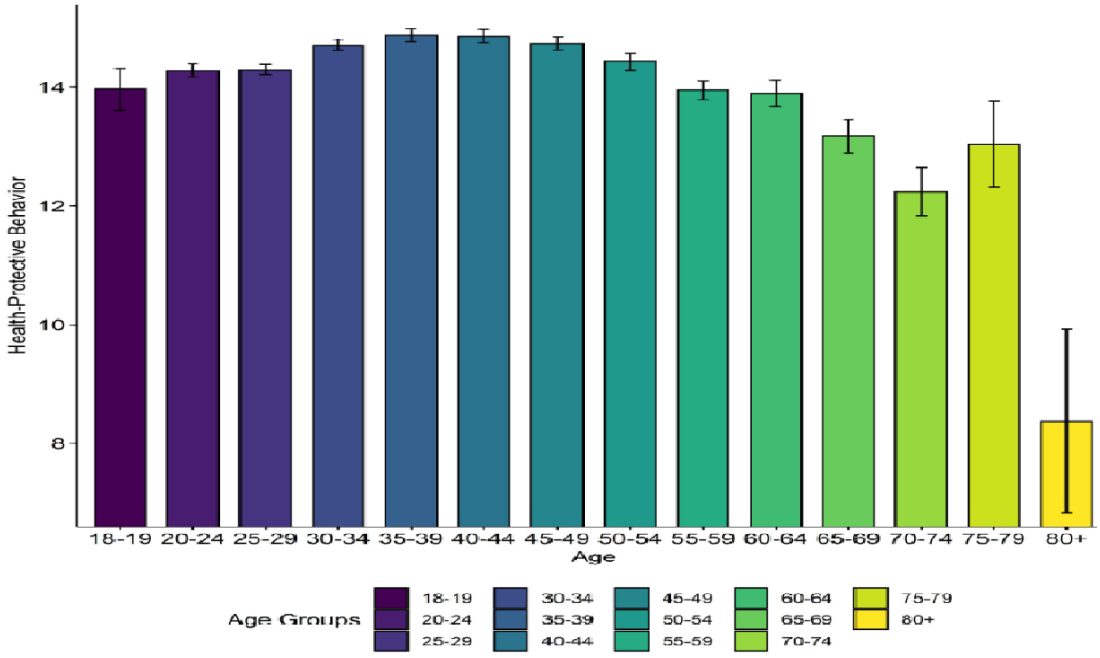

Figure 4: Health protective measures (x-axes) vs Age groups (y-axes) (Zickfeld et al., 2020).

Figure 3 and Figure 4 above show some of the results provided by the study performed to show the correlation of the behavior and attitude towards the protective measures (washing hands, wearing masks, social distance, etc.) during the initial phase of the COVID-19 outbreak. Figure 3 shows the protective measures followed by males and females with different educational backgrounds. Figure 4 shows the protective measures followed by several age groups (Zickfeld et al., 2020).

2.2 Importance of perceived risk, benefits and privacy concerns

2.2.1 Risk Perception

Terje Aven suggested a definition of risk as the "*Uncertainty about severity of the consequences of an activity with respect to something humans value* ". Risk perception was also is described as "*The individual's perception of risk is shaped by their own beliefs, affects, and experiences, regardless of whether or not they are valid*". Several factors influences an individual's perception of risk, including individual's risk assessment, professional risk assessment, feelings, attitude, past experience, expectations, and personal judgements (Aven & Renn, 2009). Figure 5 shows the differences between Risk, Professional Risk Descriptions and Risk Perception.

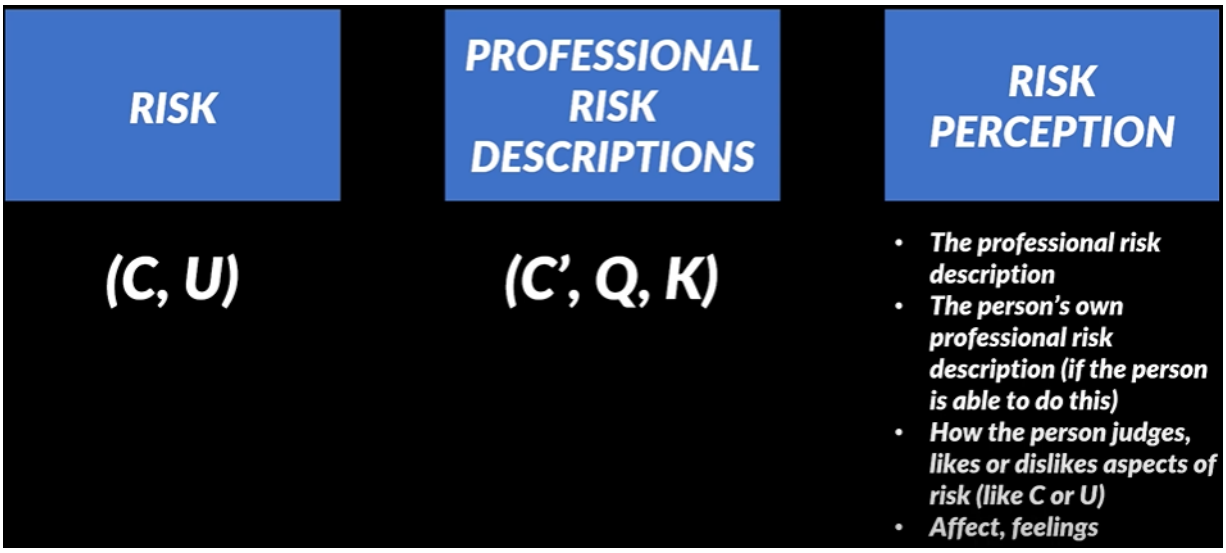

Figure 5: Difference between, risk, professional risk descriptions and risk perception differences (Aven & Thekdi, 2021).

The three factors that influences risk are professional risk assessment, individual risk assessment and perceptional risk assessment. Considering a broad perspective of risk, it is generally characterized in terms consequences (C) and uncertainties (U). In certain situations where accurate predictions are required, for accurate risk measurements, risk should be characterized professionally, in this case (C',Q,K) "*Where (C') specified consequences, (Q) a measure of uncertainty associated with C' and K the background knowledge that supports C' and Q (which includes a judgement of the strength of this knowledge)*". Hence risk, professional risk and risk perception have different characterizations. Risk perception considers both the assessment aspect and the judgment aspect, but it given be the judgement aspect (what we like, trust, disbelief, our

feelings) (Aven & Thekdi, 2021).

When events such as tsunami, wars and global pandemics happens, risk perception can affect the individuals' understanding of risk, and their reaction towards the incident. Understanding risk perception will help the society to navigate towards better understanding and building resilient societies (Dogulu et al., 2014). Individuals perceive risk differently, based on their demographic characteristics, knowledge, reasoning, worldview, value orientation, psychological traits, optimism biases, and cross-cultural differences. Although these factors are been studied by researchers, it is still not fully understood and more research should be performed across other countries around the world (Siegrist & Árvai, 2020).

Heuristics are methods or shortcuts individuals use to to solve problems, which may not be correct. There are various Heuristics types that people relay on to make decisions. Heuristics and biases may influence people's perception of risk, but it still not clear which Heuristics people relay on. There are several theoretical risk perception models that are published based on different aspects such as media, tourism and climate change. Figure 6 is an illustration of factors that influences people's perception of risk suggested by Michael Siegrist and Joseph Árvai (Siegrist & Árvai, 2020).

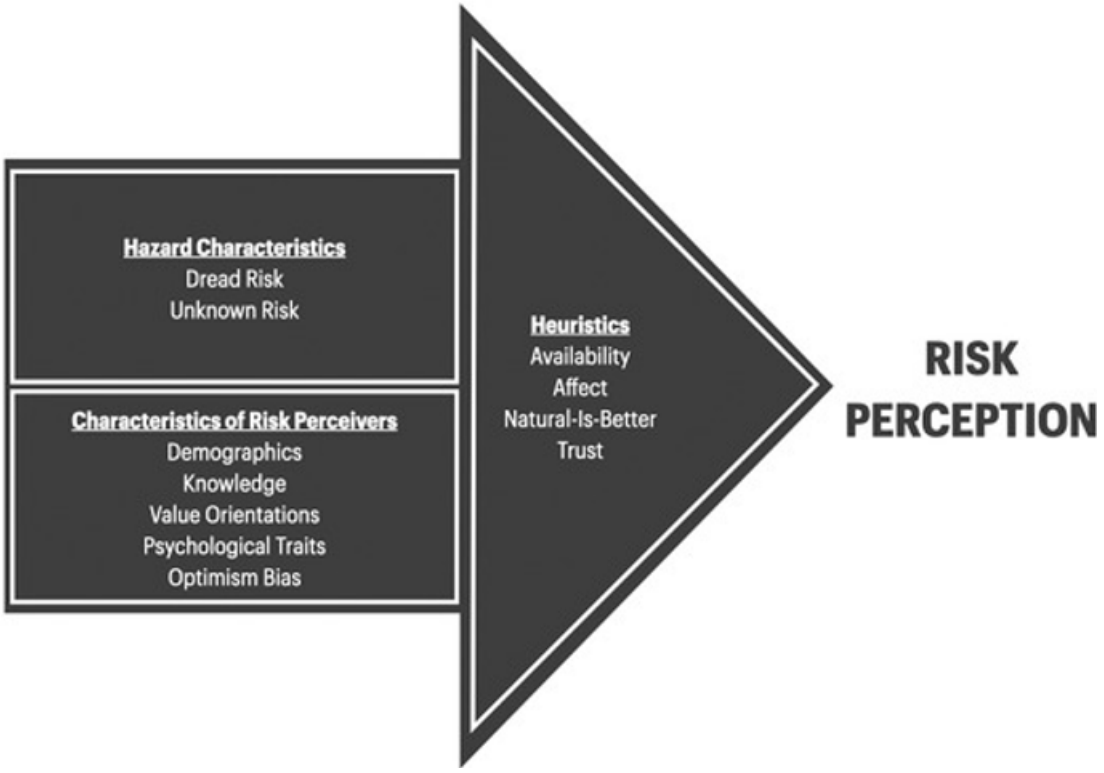

Figure 6: Factors influencing people's perception of risk (Siegrist & Árvai, 2020).

Figure 6 illustrates three general approaches that influences perceived risks. Hazard factors, where dread,- and unknown risk influence how the level of hazard is evaluated, the higher the hazard the more measures required to reduce risk. Characteristics of risk perceives describes what or how the individual's judgments is based on. The factors, Hazard characteristics and characteristics of risk perceives affect the Heuristics, which influences the risk perception (Siegrist & Árvai, 2020).

According to the psychometric paradigm, there are two main factors that influence risk perception, dread and newness, based on extensive research conducted in the 1970s . The vertical line refers to (newness) how the risk is known and the horizontal line refers to (dread) how alarmed or how frightened one should be (Aven & Thekdi, 2021). In the figure below, the second quadrant (Maximum risk perception) show that the risk is perceived as high and the risk is perceived as low in the forth quadrant.

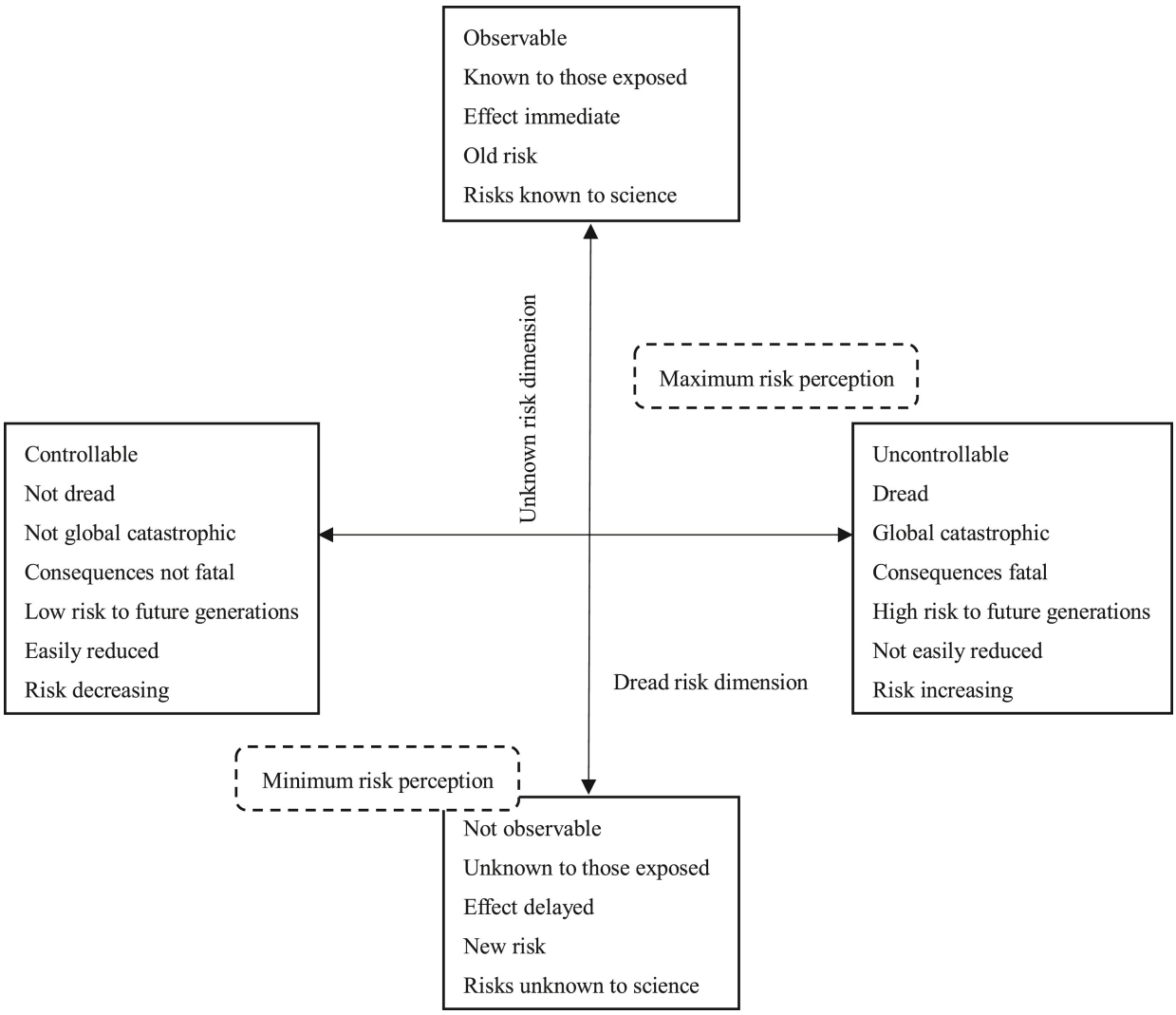

Figure 7: risk perception judgement Under the outbreak of COVID-19 (Shen et al., 2021).

- Risk attenuation: Risk is judged by the public as lower than it actually is, hence the risk perception is low (Aven & Thekdi, 2021).
- Risk amplification: Risk is judged by the public as higher than it actually is, hence the risk perception is high (Aven & Thekdi, 2021).

Considering public responses to an event, the Social Amplification of Risk Framework (SARF) model is used to explain how; "*An event assessed as low risk by professionals can be presumed as a significant risk by public as it have a large societal impact*". Figure 8 shows the extended version of SARF suggested by Fjæran and Aven, which emphasizes that in order to better understand the Amplification phase, the Attenuation phase should be extensively studied . If the response mechanisms are not applied accordingly the ripple effect in the attenuation phase will continue to the amplification phase and also causing the risk to spread in other sector (Aven & Thekdi, 2021).

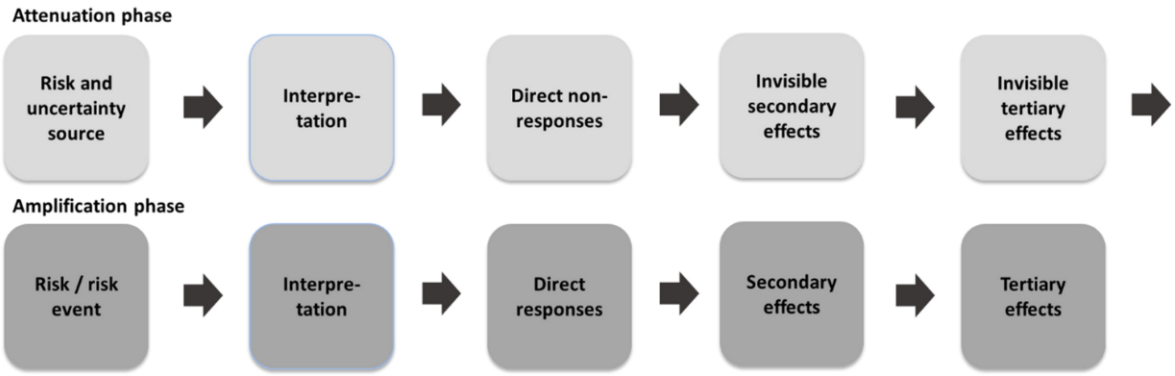

Figure 8: Extended version of SARF by Fjæran and Aven (Fjaeran & Aven, 2021).

2.2.2 Affect and risk perception

Two crucial elements to consider are one's emotional state and sense of danger. In addition, making appropriate health decisions requires the capacity to accurately estimate the costs and benefits of different options for oneself and society (Pérez-Fuentes et al., 2020). When it comes to risk perceptions, emotions often play a role, sometimes even more so than factual information (Savarese et al., 2022). It is conceivable that an emotional reaction to an event might be detrimental to impact one's thinking positively or negatively. The nature of the emotion (such as pleasant vs. unpleasant) guides people's attention to information consistent

with that emotion, for example, giving attention to negative information when feeling horrible, which leads to making wrong decisions. Rather than the actual occurrence serving as the basis for the decision-making process in the second stage, the information that was gathered will serve in this capacity (Savarese et al., 2022). Loneliness and job loss might have led to depression and led most smokers to continue or even increase smoking despite the COVID-19 warnings. On the other hand, smokers exposed to more negative emotional health warnings had more unfavorable attitudes toward health warnings and smoking and spent more time processing the warnings of increased risk, all of which impacted their risk assessment and their desire to reduce or quit smoking (Chen, 2020). As the anti-COVID-19 attitude rises, people's judgments may be based not on excellent knowledge about the virus but rather on their emotions and insufficient information about it (Burki, 2020).

Individuals are also more prone to miss essential numerical information, such as probabilities and the magnitude of a problem, when presented with strong emotional reactions to a situation (Slovic & Peters, 2006). People's attention is captured by negative framing, which is especially effective with individuals who are less statistically skilled (Reyna et al., 2009). Media coverage of COVID-19 typically portrays it in a negative light, focusing mainly on those who have been infected and who have died rather than those who have recovered or are experiencing mild symptoms. There is a possibility that this will enhance a person's mood and make them more aware of possible dangers to themselves or others that they may have previously overlooked (Buchanan et al., 2021). A more significant amount of study is required to discover if a more positive framing may be utilized to educate the public, decrease negative attitudes, and enhance public health practices (Slovic & Peters, 2006). Prejudice and discrimination are inappropriate in this situation. Not only can fear and danger affect how people see themselves, but they also have an impact on how they perceive and behave to others, especially those who are perceived to be outside their social circle (Roberto et al., 2020). According to a number of studies, higher levels of nationalism are connected with higher levels of anxiety and perceived danger to out-groups, and they are also associated with higher levels of prejudice and and discrimination. When group boundaries are violated, or when punishment or dehumanization is intensified, those who are socially excluded may exhibit less empathy than those who are not (Croucher et al., 2022).

During past pandemics, prejudice and discrimination were not uncommon. For example, during the Bubonic plague in 1348, the Catholic church believed that Jews released the plague in order to destroy Christianity, which led to a lot of prejudice and discrimination against Jews (Shrewsbury, 2005). People of Chinese descent have experienced violent attacks in most non-Asian countries due to the COVID-19 virus, and some government officials have called it the Chinese virus in order to blame China for the virus outbreak (Gover et al., 2020). Though not every pandemic is violent, it can engender prejudice and violence against marginalized or scapegoated groups and individuals (Shrewsbury, 2005). A pandemic that spreads around the globe might reduce or eliminate religious and ethnic prejudice. In addition, individuals and communities, as well as governments at the international level, may send powerful signals of shared values and cooperation, which can aid in the integration of people who were previously considered to be in and out-groups into a single community, according to the United Nations (Guadagno, 2020).

The general public has already established a cooperative behavior pattern as a response to the current pandemic (Abrams et al., 2021). For example, As of 2022, Norway has donated 2.5 million vaccine doses to COVAX (the vaccines pillar of the ACT-Accelerator) to accelerate the global vaccination process (ourworldindata, n.d.). This understanding may help improve out-group attitudes and motivate further international collaborations in the future. However, during the COVID-19 crisis, a 'panic' situation occurred, which led individuals to act selfishly. According to popular culture, panic is generally perceived to be the natural reaction of individuals when they are in danger, especially when they are in a group. Because of their need to protect themselves, they will engage in reckless, self-destructive behavior, putting their own lives and the lives of others in jeopardy. It has been used to describe the phenomenon known as "panic buying," For example, panic buying of toilet papers during the pandemic, particularly concerning the current COVID-19 pandemic, where the individuals in Norway started to panic buy during the early stages of the pandemic (Chua et al., 2021). Individuals who are more vulnerable to emotional suffering are more likely to be persuaded by selfish behavior, even if some people are more vulnerable than others. The generosity of individuals in a variety of disasters and catastrophic events is well documented daily, but there are also instances of teamwork and organized norm-governed action (Fridman et al., 2022).

2.2.3 Conspiracy theories

According to Jørgen Eirkvar and Terje Emberland, a conspiracy theory is defined as: "*Conspiracy theories are explinations that describe the secret or wicked plans and actions of a powerful group of conspirators as the most important cause of an event or state of affairs*"(Axelsen & Emberland, n.d.). During the Ebola outbreak in 2013, due to conspiracy theories and the public's mistrust towards the Guinean and several other African governments, the Ebola virus spread rapidly. Considering 2009 H1N1 pandemics, the conspiracy theorists claimed that the virus was created in a lab by the US government and was used to eliminate the poor people globally . Moreover, these claims have managed to induce public mistrust towards the government and the health authorities, which increase vaccine hesitancy (Smallman Ph D, 2015). Some of the COVID-19 conspiracy theories are; 5G mobile network helps spread COVID-19 virus, COVID-19 doesn't exist, COVID-19 was created in US, COVID-19 was created in China (Douglas, 2021).

Several claims such as the vaccine a wealthy country like Norway, where the government and the society is trusted, hence there will be less belief in conspiracy theories (Douglas, 2021). The consequences of the believing conspiracy theories might cause vaccine refusal, neglecting self protective behaviors, prejudice and racism against a certain group of people, and not complying with the government's instruction such as wearing masks and keeping social distances . There are several strategies that can be used to reduce in misleading the public's acceptance of misinformation, which needs to be studied for handling future pandemics (Douglas, 2021).

2.2.4 Perceived Risk and Vaccination

Several factors can influence the Individual's decision-making process of taking the vaccine. There have been several past pandemics that affected humans and animals. It would usually take 10 to 15 years to approve a vaccine, the COVID-19 vaccine was created and approved within 18 months, which can be also a factor that affects trust in the vaccine (Stranden, n.d.). Vaccine hesitancy is influenced by a number of factors, including trust, vaccine effectiveness, and attitude. These factors lead individuals to perceive risk related to taking the vaccine. During the 2009 H1N1 pandemic outbreak, the vaccine hesitancy was due to less trust and

doubt about the fast emerging vaccine. Although taking the vaccines was recommended to certain high-risk groups, only a few percentages agreed to take the vaccine (d'Alessandro et al., 2012).

There have been several reported cases of people who had never had COVID-19 but experienced a long-term or short term illness sickness due to vaccines, females and young people seemed to experience more severe illness (Tissot et al., 2021; Urakawa et al., 2022). For example, a former preschool teacher who volunteered in a clinical trial received a dose of the AstraZeneca vaccine and experienced blurred vision, distorted hearing, heart rate fluctuations, and muscle weakness. Moreover, several others who experienced negative symptoms were invited to a research institute, but the research had no conclusion on whether the vaccine caused these health problems (Couzin-Frankel & Vogel, 2022).

According to the study conducted in Turkey between Dec 2020 and Jan 2021, where the participants were 18 and older, some results were similar to previous vaccine hesitancy studies, which showed a reduction in vaccine hesitancy with the increase in age. Men had a higher acceptance rate than women, and better-educated individuals showed a higher acceptance rate (Dolu et al., 2021). Moreover, study conducted by (Jain et al., 2021) found that around 63.80% of students were will to get vaccinated.

Most people living in rural areas have a strong relationship between risk perception and protective behavior; rural and urban persons are likely to have distinct perspectives on risk perception and defensive behavior (Ye et al., 2021). Studies show that people living in rural areas such as the US are more likely to reject the vaccine, whereas rural people in Turkey are more likely to accept the vaccine (Dolu et al., 2021; Fisher et al., 2020).

2.2.5 Risk perception of Norwegian population about COVID-19 vaccination

A survey conducted in March 2020 by (Bonsaksen et al., 2020) shows the Norwegian population's trust in the government has increased significantly. This resulted in better communication between the politicians, administrations, health authorities and the Norwegian citizens. This trust made it easier for the citizens to follow the government's advice and guidance. The Norwegian government's initial reaction towards the COVID-19 pandemic was implementing strict infection prevention and lockdown measures. Moreover, (Bonsaksen et al., 2020) found that 19.5% of women and 12.5% of men in Norway experienced PTSD (Post-Traumatic Stress Disorder), which might be due to economical and quarantine challenges and have might further affect their decision making process.

After the COVID-19 vaccines were approved in Norway, there were several doubts about the safety and the efficiency of the vaccine. During the initial stages of the vaccine approval, several factors such as social media, political organizations, and death of health personnel due to blood clots have reduced citizens trust on certain vaccines and the government (Christensen & Lægreid, 2020). In Norway, the vaccines are free of charge, however individuals within the risk groups that were not recommended to take the vaccine were individuals that had Cancer, Chronic kidney, Chronic liver, Downs Syndrome, muscle diseases, etc. (FHI, n.d.-a).

Willingness of COVID-19 vaccination for children born to foreigners or with foreign-born parents was lower than that for children born to Norwegians with Norwegian-born parents. Individuals with foreign background have higher probability of not taking the vaccine that individuals with a Norwegian background. Moreover, similar results were shown among minority groups in several other European countries. In Norway, considering different country backgrounds Vietnamese, Thai, and Sri Lankans had the highest vaccination coverage, and the lowest vaccination coverage were followed by Bulgarians, Polish, and Romanians. Minorities working in health sector also had the lowest vaccine coverage, which also show a similarity to other European countries. Several background factors such as education, past experience and socioeconomic might also influence their decision on taking the vaccine (Kraft et al., 2021).

According to the study performed by the Norwegian Medicine Agency of the vaccine's side effects which were reported as of 06.04.2021, there were 4684 women and 950 men that experienced side effects, hence women are more likely to experience extreme reactions than men and is less likely to accept the vaccine (Nordahl, n.d.). The prolonged symptoms of the COVID-19 was studied in the of Bergen, a majority of COVID-19 survivors still suffered with COVID-19 symptoms 6 months after their infection. The study further suggested that mass vaccination could have prevented the prolonged symptoms (Blomberg et al., 2021). The Norwegian vaccination program recommended women with more that 13 weeks of pregnancy to get vaccinated. However, there were several women who decided not to get vaccinated during their pregnancy period, which resulted to a sever illness after being infected by COVID-19. In Norway around 80% of pregnant women were vaccinated by 2022 (FHI, n.d.-c). Among young women (18-30 years old), some irregular incidents of menstrual change is reported due to COVID-19 vaccination, which resulted in heavier bleeding, more pain and for longer periods. However the duration of these intensive irregularities after the vaccination are not conclusive (Trogstad, 2022).

2.3 COVID-19 vaccine hesitancy in Sweden, Italy and Taiwan

During the COVID-19 outbreak, Sweden had little to no restrictions, Italy had harsh restrictions and Taiwan also had harsh restriction but it was mainly focused on, quarantine, health protective behaviours and other measure excluding lockdown measures. This section considers the COVID-19 vaccine hesitancy in Sweden, Taiwan and Italy (Lee et al., 2022; Lindholt et al., 2021).

Sweden: When the pandemic outbreak was announced and several countries around the world announced strict restriction (i.e, staying at home, minimizing gathering, home office, online classes etc.) in order to reduce the virus spread and death of their residents. In contrast to most countries Sweden decided initially to continue without mandating any strict restrictions and a special care for the high risk individuals was considered, large gatherings were restricted, and social distancing rules and some recommendations were announced. However, strict restrictions were implemented from the second wave and on wards. As per 31 of July 2022, 19,471 people died since the outbreak of to COVID-19. (Raffetti et al., 2022; worldometersitaly, n.d.).

A study conducted by (Raffetti et al., 2022), presents that Sweden's residents' main factors that can influence the vaccine uptake are the safety of the vaccine and recommendation from the authorities. In comparison to Norway's 89%, Sweden had 61.00% vaccine acceptance rate, individuals with high education and high income were more likely to accept the COVID-19 vaccine (Lindholt et al., 2021; Sallam et al., 2022).

Italy: When the COVID-19 outbreak was announced in Italy, very harsh restriction were announced. For example, when going to or back from work, or going to a shop a form was filled by the individuals that was required by the authorities. As per 31 of July 2022, 172,086 people died since the outbreak of to COVID-19 (Gatto et al., 2020; worldometersitaly, n.d.).

Italy's COVID-19 vaccine acceptance rate was 60.00%, however a study conducted by (Reno et al., 2021) found that the main factors for vaccine hesitancy in Northern Italy was due the uncertainty of the vaccine's safety (54%) and lack of enough knowledge and trust in the vaccine's efficacy (27%). There was a positive view on the the measure (72.30%) and guidelines (82.70%) instructed by the authorities. Moreover, 51.20% claimed that the would likely take the vaccine

and 7.2% claimed that they would very likely refuse the vaccine (Falcone et al., 2020; Lindholt et al., 2021).

Taiwan: Considering Taiwan, the infection and the source of the COVID-19 was discovered on 31.December.2019. In response to the possibility of the coming COVID-19 pandemic, the government started to prepare early by being transparent to the public and initiating nationwide restrictions such as social distance, wearing masks, and also creating database for testing, tracking and isolation. Moreover there were no nationwide shutdown of schools, universities, and businesses (Su & Han, 2020).

A study conducted by (Lee et al., 2022) shows that 80.00% of the participants were concerned about the vaccine's impact on their health and around 40.00% were concerned about the vaccine's efficacy. However, those who trusted the governments recommendation were more likely to accept the vaccine. Although over 85% (as of June 2022) of the population is vaccinated, only around 50% were willing to accept the vaccine (Lee et al., 2022).

3 Risk picture

3.1 Theory of risk

The definition of risk must be understood in order to perform risk management or to manage uncertainties. The SRA (Society for Risk Analysis) Glossary states that risk is always defined in terms of a system's operations and activities. Establishing the context and identifying the stakeholders are also essential to determining the Risk picture (Aven et al., 2018). Risk assessments and probabilities are not enough to create a total risk picture. Supplementary indication, other uncertainties should be considered into the analysis depending on the situation. The main objective of risk characterization is to describe or provide a Risk picture (Aven & Thekdi, 2021).

According to Aven, Risk is characterized into five (5) variables (RS', A', C', SOK, K), where RS' is specified risk source, A' is the specified event, C' is the specified consequence, SOK is the strength of knowledge and K is the background knowledge supporting the strength of knowledge. The risk picture characterizes as (A,C,P,K), "*where A is the initiating event, C is the consequences, P is the likelihood (probability) of events and K is the background knowledge based on A,C and P*". Risk pictures are assessed and presented in various methods according to the situation, and it should also be communicated or presented such it is understandable to the stakeholder or to the public (Aven, 2015).

When the COVID-19 variants emerged, there were some concerns regarding the efficiency of the vaccine, The scientist confirmed that the vaccines were still efficient to use. Based on changing information, sensitive analysis examines how the assessed risk varies when the information used for the analysis changes. Robust analysis is used to study which factor(s) in the analysis can have a significant impact the result. Hence, the risk picture is not considered as complete unless the sensitivity and the robustness analysis is performed (Aven & Thekdi, 2021).

An individual's risk perception is influenced by his or her attitude, feelings, and conclusion about the acceptability or unacceptability of the risk. In risk perception an individuals can identify risk factors that were not considered by the professional risk assessment, hence risk

perception also considers uncertainties. As previously shown in Figure 5 the risk perception is influenced by professional risk judgement, an individuals own risk perception, and individual's judgement. Hence, additionally to the professional risk assessment several other factor are required to create a risk picture (Aven & Thekdi, 2021).

3.2 Vulnerability

Based on the occurrence of the initiating event (A), vulnerability is the uncertainty and severity of the consequences of the activity (Aven & Thekdi, 2021). Hence Risk can be divided into two:

$$Risk = \text{'Event Risk' } (A', Q, K) \ \& \ \text{Vulnerability } (C', Q, K|A')$$

A simple example provided by Amundrud, can be used to explain the model below, event A can represent the governments announcement of taking the vaccines, risk source (RS) is the COVID-19 virus, and the consequence is the public's compliance and vulnerability is the undesired consequence, which can be vaccine hesitancy.

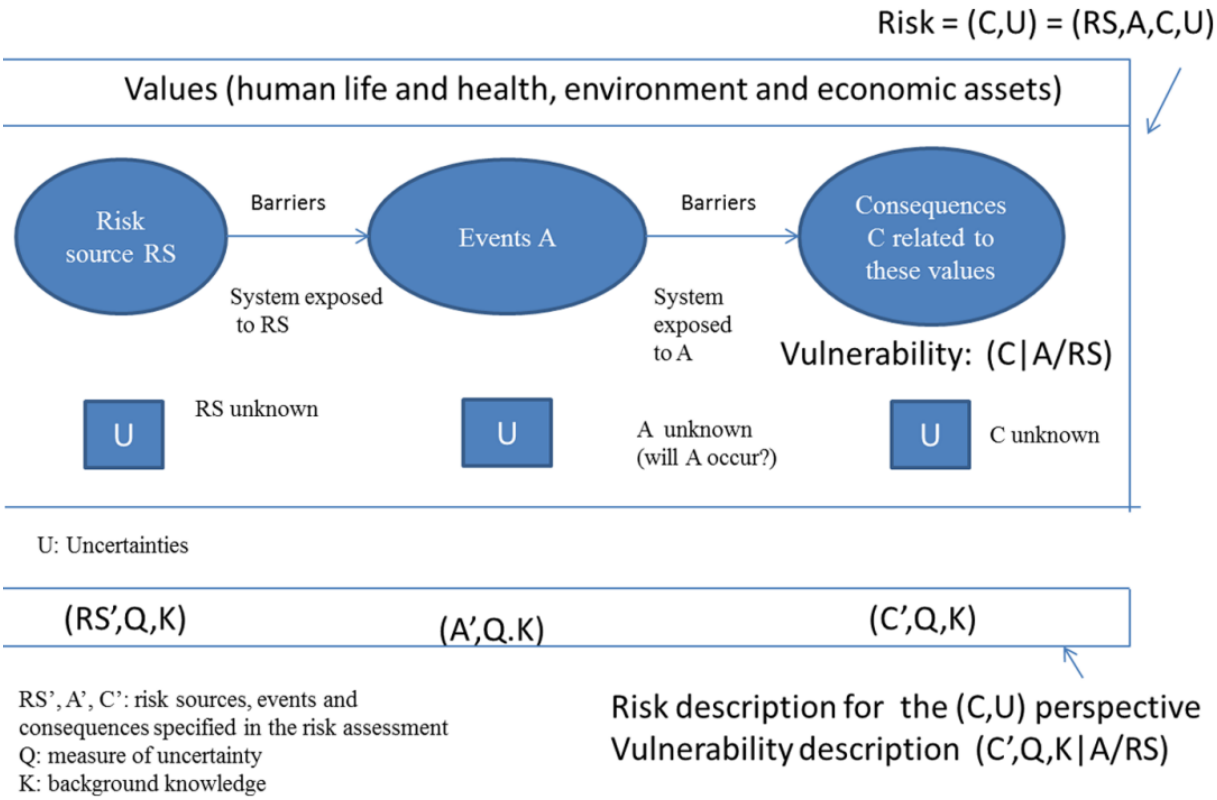

Figure 9: A conceptual model that shows how risk is closely linked to vulnerability (Amundrud et al., 2017).

A thought experiment is presented in the Figure below, which presents the concept of vulnerability for vaccine acceptance. The government just announced that the citizens' should consult their doctors and check if they are eligible to take the vaccines. Due to this citizen's trust on the government, the citizen is initially willing to take the vaccine. However, due to newly surged news/social media exposure of severe illness or emergence of a new virus variant. The citizen's risk perception is now influenced and decide to delay or take only a certain types of vaccines. Moreover, this decision might now influence other family members, which will affect the mass immunization plan of the citizens'. This weakness in the system will cause the system to be vulnerable.

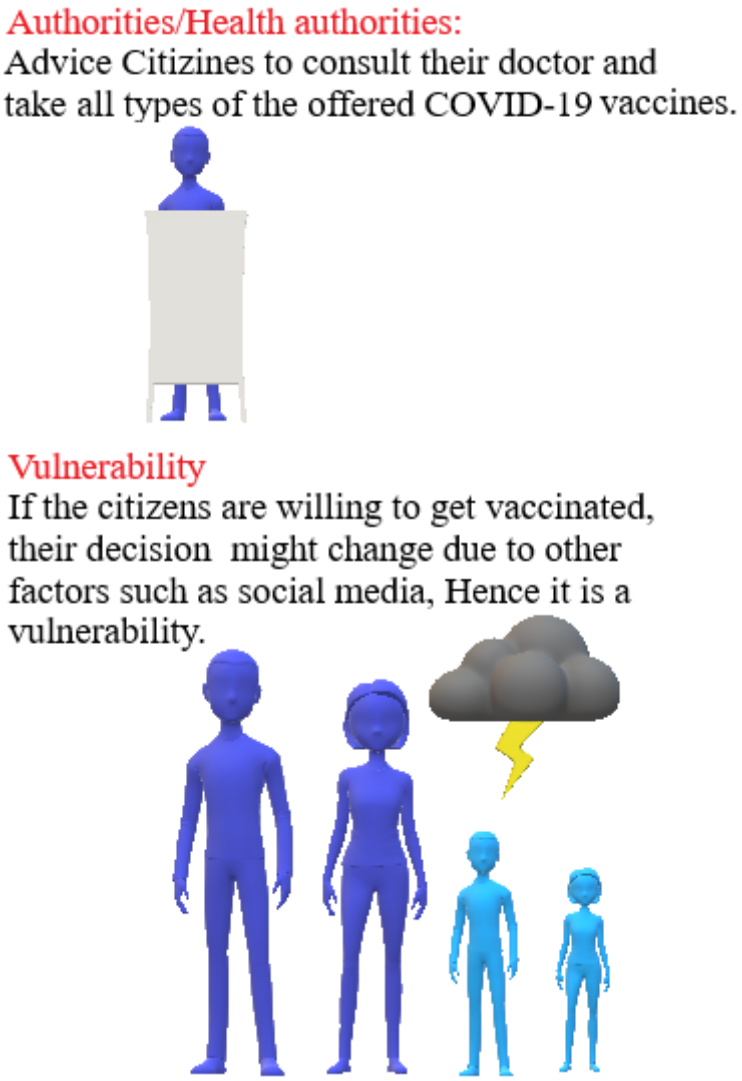

Figure 10: Example of Vulnerability(authors own creation)

4 Methodology

The purpose of the methodology section is to describe the research method used and the considerations taken into account and making it feasible for future researchers to reproduce the process and get results. A quantitative research method is used in this study, and a statistical analysis is used to analyze the data. The study is an exploratory study and it takes a cross-sectional design, meaning that data is only collected once at one point in time. In this study the questionnaire research method is designed and the results are analyzed to answer the study's objectives. There are several factors that can influence the study and produce biased results. To enhance the research quality and remove errors, diversity in, education, location, ethnicity, and gender balance perspective is pursued.

The intention of the vaccine is to increase the body's immunity level and help the body fight the COVID-19 virus and reduce severe illness or death. Negative perceptions of the vaccine can be described as, lack of trust in the effectiveness, fear of unwanted events that causes short or long lasting disabilities. Furthermore, people will refuse to take the vaccine if they perceive the risk of the vaccine as higher than the risk of conceiving the virus.

4.1 Research technique

4.1.1 Data collection

The research was conducted during the period of June 2022 to August 2022 in the form of online survey. The online survey is self administered called Pollfish (www.pollfish.com). The data was further analyzed using statistical analysis software (SPSS and R).

4.1.2 Questionnaire design

The survey is designed to answer the research question, which is to explore the risk perception of COVID-19 vaccine among Norway's residents. The respondents are above the age of 18. Based on the Health Belief Model, the survey is broken down into four categories:

- Section A: asks about demographics and health status
- Section B: asks about personal vaccination perception and knowledge
- Section C: asks about acceptance and perception of the COVID-19 vaccine

Participants were provided with a single choice alternatives to choose from while answering the question in Section A, B, and C: there were yes, no, maybe, agree, strongly agree, agree, i am not sure, disagree and strongly disagree, and there were also other statement options. Section A asks about demographics and health status (e.g., chronic disease). Section B comprises of statements about the individuals knowledge or misconceptions regarding the vaccine. Section C comprises of questions such as, what would strongly influence their decision on vaccine and willingness of taking the vaccine, as well as other factors that impact the decision to obtain the immunization.

4.2 Population and Sample

There are several definitions of population in terms research study, a suggested definition of population is: "*an aggregate of all cases that conform to some designated set of criteria*". Population is a group of individuals that are targeted for the study (for example, considering risk perception of COVID-19 vaccines in Norway, the population will be defined as all of Norway's residents) (Blaikie, 2000). In this study the whole population is anyone of interest, the target of population are the people who are accessible to the researcher. Since Pollfish can not give away the number of its active users in Norway, we take the whole population of active users of Pollfish as the sample and can also be called a census.

Sampling in terms of research study can be defined as: "*a selection of of elements from a population and maybe used to make statements about the whole population*". Sampling is selecting certain individuals or groups from the population in order to produce a more representative data (Blaikie, 2000). The sample in this study is only representative for this study and not for the general population of Norway.

The survey yielded 150 respondents. A convenience sampling method is used to collect data. The convenience sampling method may not accurately represent the population; for example,

people with higher education mostly tend to answer surveys, hence this may not be representative of the population since individuals with less education are not included. To reduce such errors an online survey service (www.pollfish.com) was used to collect data from a representative audience. For example, considering the risk perception of COVID-19 vaccines in Norway, among the population in the study, a mixture of ethnic, educational and employment background are considered for the study, hence individuals with disabilities, older people living in the pension home are excluded.

4.3 Ethical considerations

An ethical consideration and its requirements are applied to the social science research, also considering the resources published by the Norwegian National Ethics Committee. Since the survey do not include any collection of personal and sensitive information, a research approval was not needed from the Norwegian National Ethics Committee. It was explained to participants what the study was about and how it would be conducted, as well as their right to confidentiality (Ingierd, n.d.).

4.4 Study variables

The two variable that are considered in this study are Independent variable and Dependent variables. Independent variables are the factors or attributes that can influence the outcome. Dependent variable are the outcomes that are caused by the independent variables. Therefore, the independent variable is a significant predictor of the dependent variable (Blaikie, 2000).

Dependent and Independent variables

In this study the dependent variables are considered as personal opinions, beliefs, knowledge, biases and the individual's choice to accept or reject the vaccine. Independent variables are also considered as; gender, age, martial status, education, employment status, race, yearly income, social media, attitude, behavior, and personal regarding the vaccine.

5 Results and Analysis

The purpose of chapter is to present the descriptive and the statistical results of the project. First, the descriptive results for the project's demographic variables and questions regarding COVID-19 vaccination attitudes, knowledge, and behaviors will be discussed. Second, a brief section explaining how to interpret the statistical models conducted to answer the project's objectives will be presented. Lastly, the statistical reports for the multiple binary logistic regression models will be discussed.

5.1 Descriptive Analysis

The tables below presents the sociodemographic characteristics of the respondents.

Table 1: Demographics Table

Variables	**Categories**	**n (frequency)**	**% (percentage)**
Gender	Female	67	44.67
	Male	83	55.33
	Other	0	0.00
Age	18 24	52	34.67
	25 -34	43	28.67
	35 - 44	34	22.67
	45 - 54	12	8.00
	$>$ 54	9	6.00
Martial Status	Single	54	36.00
	Living With Partner	38	25.33
	Married	39	26.00
	Divorced	7	4.67
	Separated	1	0.67
	Prefer Not To Say	8	5.33
	Widowed	3	2.00

Table 2: Demographic Table (continue)

Variables	**Categories**	**n**	%
Education	Elementary School	0	0.00
	Middle School	14	9.33
	High School	49	32.67
	University	54	36.00
	Postgraduate	13	8.67
Employment Status	Employed For Wages	97	64.67
	Student	32	21.33
	Vocational-College	20	13.33
	Unemployed Looking	21	14.00
Race	White	109	72.67
	Arab	10	6.67
	Asian	13	8.67
	Black	7	4.67
	Multiracial	2	1.33
	Other	5	3.33
Income/YR	Under 200 000 NOK	30	20.00
	200K - 299K NOK	13	8.67
	300K - 549K NOK	27	18.00
	550K - 799K NOK	22	14.67
	800K - 999K NOK	13	8.67
	1M - 1.2M NOK	11	7.33
	$>$ 1.2M NOK	16	10.67
	Prefer not to say	18	12.00

To address the study's objective, participants were asked several questions to get their perceptions on the COVID-19 vaccines. The table below shows the questions asked regarding the respondent's knowledge, attitude and behavior towards the vaccine and to understand the pattern that influences the decision making of the vaccine uptake.

Table 3: Survey frequency table - COVID-19 vaccine perception

Variables	**Categories**	**n**	**%**
Q4. Did you know that the vaccines against COVID-19 contain inactivated Coronaviruses?	Yes	113	75.33
	No	37	24.67
Q5. Do you think that the COVID-19 vaccines can change or interact with your DNA in any way?	Yes	59	39.33
	No	91	60.67
Q6. Did you know that everyone including children can receive COVID-19 vaccination?	Yes	113	87.33
	No	19	12.67
Q7. Do you think that the COVID-19 vaccine can also protect us from influenza?	Yes	22	14.67
	No	64	42.67
	Maybe	64	42.67
Q8. Do you think that the COVID-19 vaccine can protect other people who did not receive the vaccine?	Yes	69	46.00
	No	53	35.33
	Maybe	28	18.67
Q9. Do you think that the COVID-19 vaccine do not have side effects?	Yes	22	14.67
	No	106	70.67
	Maybe	22	14.67

Table 4: Survey frequency table - COVID-19 vaccine perception (continue)

Variables	**Categories**	**n**	**%**
Q10. Would you recommend others to get vaccinated ?	Yes	77	51.33
	No	17	11.37
	It depends (Age, health status)	56	37.33
Q11. What are the factors that can influence your decision to take COVID-19 Vaccine?	Vaccine effectiveness	43	28.67
	Recommendation (doctors, authorities)	51	34.00
	Amount of increasing positive COVID-19 cases	25	16.67
Q12. Do you think that your health will change negatively after getting the COVID-19 vaccine?	Yes, negatively and for a long term	14	9.33
	Yes, negatively but for a short term only	21	14.00
	I am not sure	57	38.00
	No, positively but i am not sure	30	20.00
	No, it will not change at all	28	18.67
Q18. In the event of infection with Covid-19 after getting vaccinated, how likely do you expect your illness due to side effects to increase?	Less than 50%	57	38.00
	More than 50%	36	24.00
	No difference	57	38.00
Q19. Which dose of vaccine can cause the longest-lasting or most severe side effects?	First dose	53	35.33
	Second dose	50	33.33
	Third dose	25	16.67
	Booster dose	22	14.67
Q20. Are you willing to get vaccinated if the vaccine is offered for you?	Yes, I will accept all vaccines	62	41.33
	Yes, I will accept only certain vaccines	48	32.00
	Maybe, I might delay on taking the Vaccine	20	13.33
	No, I will refuse	15	10.00
	No, I refuse to accept all vaccines	5	3.33

Residents living outside the major Norwegian cities

The Figure below show the respondents percentage based on county in Norway. However, 70.67% of the respondents live outside the major Norwegian cities (i.e. Oslo, Bergen, Trondheim, Kristiansand and Stavanger).

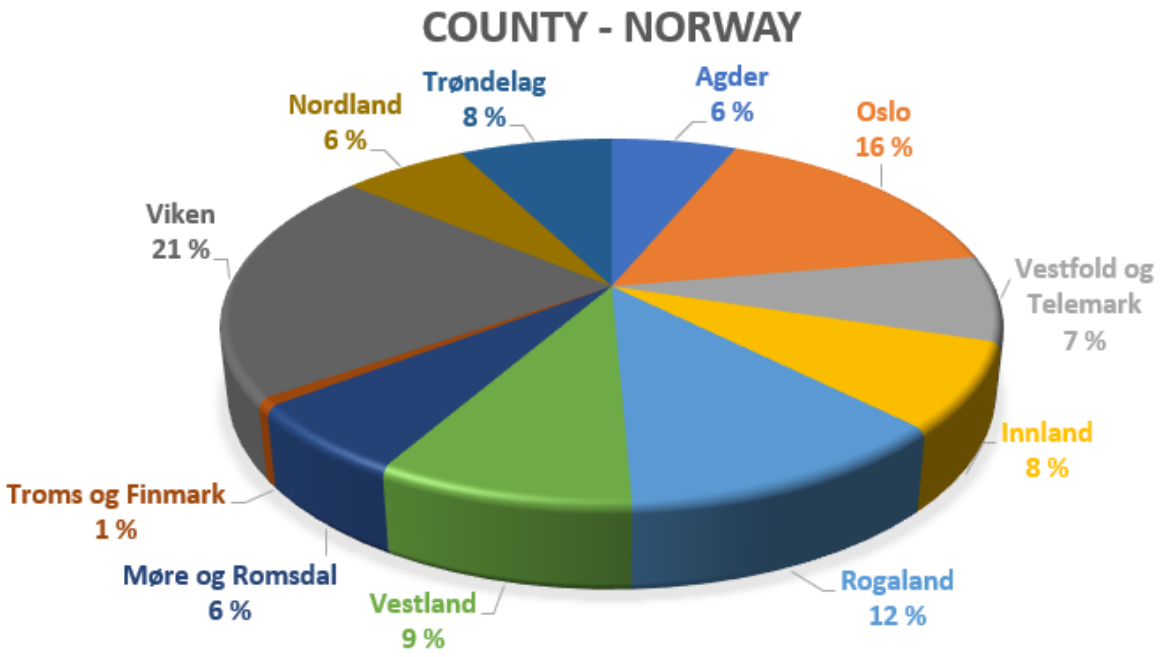

Figure 11: Percentage of respondents based on County in Norway.

Considering those who live outside the major Norwegian cities; 48.11% have chronic disease(s), 74.53% claimed to have the complete information regarding the COVID-19 vaccine, and 47.17% claimed that the vaccine can also protect others who did not received the vaccine. Considering the factors that can influence the vaccine uptake, 33.96% and 33.02% claimed that the vaccine effectiveness and the recommendation from authorities respectively can influence their decision on the taking the vaccine. However, 30.19% claimed that the vaccine is not as effective as it should be. Considering the side effects, 73.58% claimed that the vaccine have side effects but 34.91% were not sure that these side effects would affect their health negatively. Moreover, 73.59% confirmed that the vaccine is perceived negatively through several social media platforms, and 33.96% found it easy to decide whether to get vaccinated or not. Considering the willingness to get vaccinate, 40.57% reported that they are willing to accept all offered vaccines, where 14.15% were not sure and 1.89% reported to refuse all offered vaccines.

Influencing factors of COVID-19 vaccine perception

The result of the analysis revealed that more males (55.33%) than females (44.67%) participated in the survey, and 71.33% of all respondents claimed that they had the complete information regarding the COVID-19 vaccine. Among the respondents 45.78% and 43.28% of males and females respectively reported to have one chronic disease or the other. Based on gender, the female reported that recommendation from doctors or ministry of health (32.84%) as the leading factor, followed by the effectiveness of the vaccine (31.3%), and likewise the unexpected negative effect on health (23.88%) whilst the least factor that could influence their decision towards the uptake of the COVID-19 vaccine was the amount of increasing positive cases of COVID-19 (11.94%). Just like the female, the male reported recommendation from doctors or ministry of health (34.94%) as the leading factor that could influence the decision to take COVID-19 vaccine, followed by vaccine effectiveness (26.51%), amount of increasing positive COVID-19 cases (20.48%) and unexpected negative effects on health (18.07%). Considering the willingness of getting vaccinated, 45.78% and 35.82% males and females respectively, reported that they are willing to accept all offered vaccines, while 2.41% and 4.48% males and females respectively, reported to refuse all offered vaccines. However, male and female that responded that the recommendation from doctor and ministry of health as a leading factor that can influence their decision, 68.97% and 45.45% of those male and female respectively reported that they are willing to accept all offered vaccines, while 0.00% of both male and female responded that they will refuse to accept all offered vaccine.

Social Media Influence

Based on gender, the female who agreed and strongly agreed that the social media displayed a negative perception of the COVID-19 vaccine, 39.58% and 41.67% responded to accept all offered vaccines and accept only certain vaccines respectively. However, 14.58% responded that they would delay and 2.08% claimed to refuse all the offered vaccines. Just like the female, the male who agreed and strongly agreed that the social media displayed a negative perception of the COVID-19 vaccine, 44.83% and 34.48% responded to accept all offered vaccines and accept only certain vaccines respectively. However, 8.62% responded that they would delay and 1.72% claimed to refuse all the offered vaccines.

Perception of Effectiveness on COVID-19 vaccine

On the effectiveness of the vaccine, more participants above 54 y/o (33.33%) strong agreed that vaccine may not be as effective as it ought to be compared to those that were 35-44 y/o (8.82%), 25-34 y/o (11.63%) and 18-24 (9.62%). Whilst those age 45-54 y/o agreed by 50.00% that the vaccine may not be as effective as it should be, 32.56% of those between 25-34 y/o shares similar perception on the ineffectiveness of the vaccine. However, 33.33% of those who were above 54 y/o still considered that the vaccine was effective, followed by 32.35% of those between 35-44 y/o, and 25.00% of those between 45-54 y/o. Moreover, about four in every ten of those between 18-24 y/o were not sure of the effectiveness of the vaccine, 33.33% of the older population (>54) disagreed that they vaccines may not be effective as 11.11% of the same population strongly disagree. Uncertainty of the effectiveness of the vaccine has more percentages across each of the categories of participants based on their marital status, 38.89% of the single respondents were not sure and 31.48% agreed that the vaccine may not be as effective as it should be. Those living with their partner (28.95%), divorced (28.21%) and separated (100%) disagree that the vaccine may not be as effective as it should be. More of the married (28.2%) compared to the divorced (14.29%) and those living with their partners (21.05%) agreed that the vaccine may not be as effective as it should be.

5.2 Inferential Statistics Results

Statistical Analysis and Data Editing

The statistical test used for all the hypothesis testing analyses is multiple binary logistic regression. Multiple binary logistic regression is a statistical test that examines how multiple independent variables can predict the values of a binary dependent variable (Nick & Campbell, 2007). A binary variable only has two categories (e.g., yes or no questions or Gender having male or female choices). Some variables were re-coded statistical to be entered as the dependent variables in the logistic regression models. This data editing was mainly done to avoid using more complex models. For example, the responses to the question " Q7 Do you think that the COVID-19 vaccine can also protect us from influenza?" was re-coded to "No" = 0, and all other values equal 1. This re-coding was also done for some demographic variables such as gender, education, employment status, and race so they can be entered more easily in the logistic regression models.

Interpretation Logistic Regression

The tables below are a series of multiple binary logistic regression models used to examine whether demographic variables and opinions about the vaccine can predict the dependent variables regarding COVID-19 vaccination knowledge and behaviors.

The p (p-value) column and the OR (Odds Ratio) column are the two columns to pay attention to when interpreting the results on the table. P-value columns indicate which independent variables predict the dependent variable significantly. An independent variable is a significant predictor of the dependent variable if its p-value is less than .050 (Nick & Campbell, 2007). An independent variable that is statistically significant needs to be analyzed based on its OR to determine the type of relationship it has with the dependent variable. The OR greater than one ($OR > 1$) indicates that higher scores of the independent variable are associated with a greater likelihood of the event occurring (Nick & Campbell, 2007). OR less than one ($OR < 1$) means that there is a lower probability of the event occurring when higher scores of the independent variable are recorded. Significant predictors and their p-values are bolded within each table for easier identification.

A multiple binary logistic regression model is statistically significant overall when the model's

p-value is less than .050. The presence of a significant model indicates that the model is better than one with no predictors. The lower limit confidence interval (LLCI) and the upper limit confidence interval (ULCL) values are a range of values we are 95% confident the true population OR value for each independent variable is within. The LLCI and ULCI values are just used for statistical estimation, and it's not needed for the interpretation since the p-values are already included (Nick & Campbell, 2007).

Multiple binary logistic regression was conducted to examine the followings:

- To examine if demographic variables and opinions regarding the vaccine predicted whether participants thought that COVID-19 vaccines contained inactive corona-viruses that worked as immune stimulants.
- To examine if demographic variables and opinions regarding the vaccine predicted whether participants thought the COVID-19 vaccines could alter DNA.
- To examine if demographic variables and opinions regarding the vaccine predicted whether participants think everyone, including children, can receive the COVID-19 vaccine.
- To examine if demographic variables and opinions regarding the vaccine predicted whether participants think the COVID-19 vaccine can protect against influenza.
- To examine if demographic variables and opinions regarding the vaccine predicted whether participants think the COVID-19 vaccine can protect others who did not receive the vaccine.
- To examine if demographic variables and opinions regarding the vaccine predicted whether participants think the COVID-19 vaccine has no side effects.
- To examine if demographic variables and opinions regarding the vaccine predicted whether participants would take the COVID-19 vaccine if offered.
- To examine if demographic variables and opinions regarding the vaccine predicted whether participants thought the vaccine would negatively impact their health (either short or long term).
- To examine if demographic variables and opinions regarding the vaccine predicted whether participants would recommend the vaccine to other people.

5.2.1 Multiple binary Logistic regression results

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine can predict whether participants thought that COVID-19 vaccines contained inactive corona-viruses that worked as immune simulators. The p-values ($p < .05$) indicate whether independent variables significantly predict the dependent variable as well as the OR values which indicate whether independent variables are related to each other.

Table 5: Logistic Regression Table Predicting Participants' Vaccine Knowledge 1 Response

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age	1.00	0.02	0.12	.903	0.96	1.05
Male	0.83	0.42	-0.44	.661	0.36	1.89
University Education	1.23	0.46	0.45	.654	0.50	3.12
Single	0.35	0.73	-1.43	.153	0.07	1.33
Married	0.68	0.86	-0.45	.655	0.11	3.41
Living with Partner	0.60	0.80	-0.64	.525	0.11	2.70
White	2.40	0.46	1.91	.056	0.98	5.94
Low Income (less than 300 000 NOK/YR)	0.85	0.47	-0.36	.721	0.34	2.17
Employed Wages	0.53	0.65	-0.97	.330	0.14	1.81
Student	0.90	0.74	-0.15	.882	0.20	3.76
Vaccine Ineffectiveness	0.96	0.22	-0.16	.870	0.63	1.49
Negative Effects	0.69	0.23	-1.60	.110	0.43	1.08
Vaccine Indecision	1.17	0.19	0.85	.395	0.81	1.72
Social Media Influence	1.10	0.18	0.53	.594	0.77	1.57
Vaccine Inaccessibility	1.03	0.19	0.14	.892	0.71	1.49

Multiple binary logistic regression was conducted to examine if demographic variables and opinions regarding the vaccine predicted whether participants thought that COVID-19 vaccines contained inactive corona-viruses that worked as immune stimulants. The model was not statistically significant ($X^2(15) = 12.58, p = .634, R^2_{Tjur} = .08$). Therefore, the result shows that none of the variables predicted whether participants thought that COVID-19 vaccines contained inactive corona-viruses that worked as immune stimulants.

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine can predict whether participants thought the COVID-19 vaccines could alter DNA.

Table 6: Logistic Regression Table Predicting Participants' Vaccine Knowledge 2 Response

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age	1.01	0.02	0.33	.742	0.96	1.05
Male	1.25	0.44	0.51	.608	0.53	3.02
University Education	3.76	0.52	2.52	0.12	1.39	11.03
Single	0.71	0.66	-0.52	.602	0.19	2.61
Married	0.25	0.78	-1.78	.075	0.05	1.13
Living with Partner	0.12	0.79	-2.72	**.007**	0.02	0.53
White	0.25	0.50	-2.78	**.005**	0.09	0.65
Low Income	2.03	0.51	1.38	.167	0.74	5.66
Employed Wages	1.56	0.66	0.67	.503	0.43	5.85
Student	0.68	0.71	-0.55	.585	0.17	2.75
Vaccine Ineffectiveness	1.46	0.23	1.65	.099	0.94	2.32
Negative Effects	1.59	0.24	1.95	0.51	1.01	2.59
Vaccine Indecision	1.41	0.20	1.75	.080	0.96	2.10
Social Media Influence	1.43	0.20	1.77	.077	0.97	2.16
Vaccine Inaccessibility	0.98	0.19	-0.12	.902	0.67	1.42

Multiple binary logistic regression was conducted to examine if demographic variables and opinions regarding the vaccine predicted whether participants thought the covid-19 vaccines could alter DNA. The model was statistically significant ($X^2(15) = 57.86, p < .001, R^2_{Tjur} = .34$). Living with a partner ($OR = .12, p = .007$) and racial group ($OR = .25, p = .005$) were found to be significant predictors of whether participants believed the COVID-19 vaccine. Therefore results show that participants with living partners and white participants were less likely to think that COVID-19 vaccine alters DNA compared to other marital status groups and non-white participants.

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine can predict whether everyone, including children, can receive the COVID-19 vaccine.

Table 7: Logistic Regression Table Predicting Participants' Vaccine Knowledge 3 Response

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age	0.98	0.03	-0.74	.458	0.92	1.04
Male	0.34	0.68	-1.57	.117	0.08	1.24
University Education	2.01	0.74	0.95	0.344	0.50	9.53
Single	1.05	0.95	0.06	.956	0.14	6.52
Married	0.56	1.14	-0.51	.608	0.05	5.11
Living with Partner	0.47	0.99	-0.76	.444	0.06	3.03
White	5.10	0.66	2.47	**.013**	1.44	19.89
Low Income	0.78	0.68	-0.36	.716	0.21	3.08
Employed Wages	1.27	0.97	0.25	.803	0.17	7.98
Student	0.33	0.98	-1.14	.254	0.04	2.05
Vaccine Ineffectiveness	1.94	0.34	-1.38	.168	0.31	1.20
Negative Effects	0.62	0.34	-1.38	0.168	0.31	1.20
Vaccine Indecision	0.64	0.29	-1.35	.177	0.37	1.16
Social Media Influence	0.68	0.29	-1.40	.162	0.38	1.16
Vaccine Inaccessibility	0.68	0.28	-1.40	.162	0.38	1.16

Multiple binary logistic regression was conducted to examine if demographic variables and opinions regarding the vaccine predicted whether participants think everyone, including children, can receive the COVID-19 vaccine. The model was statistically significant ($X^2(15) = 32.75, p = .005, R^2_{Tjur} = .27$). Racial group ($OR = 5.10, p = .013$) was a significant predictor of whether participants believed everyone, including children, could receive the COVID-19 vaccine. Therefore, the results show that white participants are more likely to think everyone,

including children, can receive the COVID-19 vaccine than non-white participants.

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine predict whether participants think the COVID-19 vaccine can protect against influenza.

Table 8: Logistic Regression Table Predicting Participants' Vaccine Knowledge 4 Response

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age	0.97	0.02	-1.68	.094	0.93	1.00
Male	1.12	0.40	0.28	.778	0.51	2.48
University Education	0.93	0.43	-0.16	0.872	0.40	2.20
Single	2.28	0.65	1.27	.202	0.65	8.38
Married	3.06	0.74	1.50	.133	0.74	14.04
Living with Partner	3.43	0.72	1.71	.086	0.87	14.90
White	0.42	0.47	-1.83	.067	0.16	1.04
Low Income	2.28	0.48	1.71	0.088	0.90	6.10
Employed Wages	1.00	0.65	0.01	.994	0.28	3.55
Student	0.70	0.73	-0.49	.623	0.16	2.88
Vaccine ineffectiveness	1.24	0.21	-1.03	.302	0.83	1.87
Negative Effects	0.41	0.24	-3.67	$<$ **.001**	0.25	0.65
Vaccine Indecision	0.97	0.18	-0.19	.847	0.67	1.39
Social Media Influence	1.24	0.17	1.27	.205	0.89	1.75
Vaccine Inaccessibility	1.65	0.18	2.77	**.006**	1.17	2.39

Multiple binary logistic regression was conducted to examine if demographic variables and opinions regarding the vaccine predicted whether participants think the COVID-19 vaccine can protect against influenza. The model was statistically significant ($X^2(15) = 38.04, p = .001, R^2_{Tjur} = .231$). Participants' opinions towards the vaccine's negative health implications ($OR = .41, p < .001$) and accessibility due to high demand ($OR = 1.65, p = .006$) were

significant predictors of whether they believed the vaccines could protect against influenza. Therefore, the stronger participants who believed the vaccine could cause negative side effects on health were less likely to believe the vaccine could protect unvaccinated individuals. Those who are more likely to believe that vaccines may not be accessible due to high demand are more likely to believe the vaccine could protect unvaccinated individuals.

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine can predict whether participants think the COVID-19 vaccine can protect others who did not receive the vaccine.

Table 9: Logistic Regression Table Predicting Participants' Vaccine Knowledge 5 Response

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age	0.98	0.02	-1.28	.200	0.94	1.01
Male	0.99	0.39	-0.02	.986	0.46	2.14
University Education	1.25	0.42	0.53	0.595	0.55	2.89
Single	0.74	0.63	-0.48	.629	0.20	2.46
Married	0.87	0.71	-0.20	.840	0.20	3.41
Living with Partner	0.94	0.69	-0.08	.935	0.23	3.61
White	1.95	0.43	1.54	.124	0.83	4.63
Low Income	1.39	0.45	0.73	.466	0.58	3.44
Employed Wages	0.89	0.58	-0.20	.840	0.28	2.78
Student	1.61	0.66	0.73	.467	0.44	5.99
Vaccine Ineffectiveness	0.62	0.21	-2.31	**.021**	0.41	0.92
Negative Effects	0.94	0.20	-0.31	.756	0.63	1.41
Vaccine Indecision	1.17	0.18	0.87	.382	0.83	1.67
Social Media Influence	1.38	0.17	1.93	.053	1.00	1.93
Vaccine Inaccessibility	0.82	0.17	-1.13	.257	0.58	1.15

Multiple binary logistic regression was conducted to examine if demographic variables and

opinions regarding the vaccine predicted whether participants think the COVID-19 vaccine can protect others who did not receive the vaccine. The model was not statistically significant ($X^2(15) = 18.53, p = .236, R^2_{Tjur} = .12$). However, participants' opinions towards the vaccine's negative health implications ($OR = .62, p = .021$) was found to be a significant predictor of whether they thought the COVID-19 vaccine could protect others who did not receive the vaccine. Therefore, the stronger participants who believed the vaccine could cause negative side effects on health were less likely to believe the vaccine could protect others who did not receive the vaccine.

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine can predict whether participants think the COVID-19 vaccine has no side effects.

Table 10: Logistic Regression Table Predicting Participants' Vaccine Knowledge 6 Response

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age: 18-24	0.04	1.57	-2.02	.043	0.00	0.80
Age: 25-34	1.99	0.61	1.13	.260	0.61	6.86
Age: 35-44	2.37	0.67	1.29	.196	0.65	9.07
Age: 45-54	0.28	1.26	-1.00	.316	0.01	2.55
Age: >54	12.67	0.99	2.58	**.010**	2.04	104.04
Male	2.73	0.47	2.13	**.033**	1.11	7.20
University Education	0.69	0.49	-0.76	.448	0.25	1.79
Single	1.05	0.71	0.07	.948	0.26	4.48
Married	1.26	0.79	0.29	.770	0.27	6.25
Living with Partner	1.24	0.75	0.29	.771	0.29	5.76
White	0.51	0.49	-1.38	.168	0.19	1.34
Low Income	2.57	0.48	1.97	**.049**	1.01	6.71
Employed Wages	1.65	0.66	0.76	.445	0.47	6.30
Student	4.02	0.76	1.84	.066	0.95	18.95
Vaccine Ineffectiveness	1.55	0.23	1.89	.059	0.99	2.49
Negative Effects	0.59	0.24	-2.13	**.033**	0.36	0.95
Vaccine Indecision	0.98	0.20	-0.11	.912	0.65	1.46
Social Media Influence	1.00	0.19	-0.01	.993	0.68	1.47
Vaccine Inaccessibility	1.46	0.20	1.87	.062	0.99	2.21

Multiple binary logistic regression was conducted to examine if demographic variables and opinions regarding the vaccine predicted whether participants think the covid-19 vaccine has no side effects. The model was statistically significant ($X^2(18) = 28.44, p < .009, R^2_{Tjur} = .023$). Gender ($OR = 2.73, p = .033$) and age>54 ($OR = 12.67, p = .010$), Income ($OR = 2.57, p = .049$), and belief that the COVID-19 vaccine will have negative side effects ($OR = 0.59, p = .033$) were significant predictors of whether participants thought the covid-19 vaccines had no side effects. Therefore, the results show that males, participants who are older than 54, and participants who make less than 300,000 NOK/YR income were more likely to believe the vaccine had no side effects. The stronger participants who believed the vaccine would have negative health effects were less likely to believe the vaccine had no side effects.

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine can predict whether participants would take the vaccine if offered.

Table 11: Logistic Regression Table Predicting whether Participants' would take the vaccine if offered

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age	1.02	0.02	0.64	.520	0.97	1.07
Male	1.02	0.48	0.04	.965	0.39	2.64
University Education	0.74	0.52	-0.56	.573	0.26	2.09
Single	1.30	0.72	0.37	.714	0.31	5.34
Married	1.50	0.84	0.48	.628	0.28	7.83
Living with Partner	1.59	0.82	0.56	.574	0.31	8.13
White	3.08	0.50	2.24	**.025**	1.16	8.46
Low Income	0.49	0.51	-1.39	.164	0.18	1.35
Employed Wages	3.51	0.65	1.93	.053	1.00	12.96
Student	3.93	0.71	1.93	.054	1.01	16.67
Vaccine ineffectiveness	0.80	0.25	-0.87	.382	0.48	1.31
Negative Effects	0.63	0.26	-1.77	.077	0.37	1.04
Vaccine Indecision	0.58	0.20	-2.64	**.008**	0.38	0.86
Social Media Influence	1.11	0.19	0.56	.576	0.76	1.62
Vaccine Inaccessibility	1.49	0.22	1.79	.073	0.98	2.35

Multiple binary logistic regression was conducted to examine if demographic variables and opinions regarding the vaccine predicted whether participants would take the covid-19 vaccine if offered. The model was statistically significant ($X^2(15) = 47.78, p < .001, R^2_{Tjur} = .31$). Racial group ($OR = 3.08, p = .025$) and vaccine indecision ($OR = .58, p = .008$) was found to be significant predictors of whether participants would take the vaccine if offered. Therefore,

the results show that white participants are more likely to take the vaccine if offered compared to non-white participants. Those more indecisive about taking the vaccine are less likely to take it if offered.

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine can predict whether participants think the vaccine will have negative health implications.

Table 12: Logistic Regression Table Predicting whether Participants believed the vaccine with have Negative Effects

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age	1.03	0.03	1.10	.270	0.98	1.09
Male	1.07	0.50	0.13	.895	0.40	2.93
University Education	3.07	0.55	2.04	**.041**	1.07	9.41
Single	0.70	0.78	-0.46	.646	0.15	3.45
Married	0.28	0.91	-1.40	.163	0.04	1.70
Living with Partner	0.57	0.87	-0.63	.526	0.10	3.27
White	0.37	0.55	-1.83	.067	0.12	1.07
Low Income	0.10	0.71	-3.19	**.001**	0.02	0.38
Employed Wages	0.25	0.85	-1.62	.104	0.04	1.28
Student	0.23	0.78	-1.89	.059	0.05	1.05
Vaccine Ineffectiveness	1.05	0.26	0.20	.844	0.62	1.77
Negative Effects	1.70	0.27	1.94	.053	1.01	2.96
Vaccine Indecision	1.33	0.22	1.33	.183	0.87	2.06
Social Media Influence	1.57	0.25	1.82	.068	0.99	2.65
Vaccine Inaccessibility	1.48	0.21	1.83	.067	0.98	2.28

Multiple binary logistic regression was conducted to examine if demographic variables and opinions regarding the vaccine predicted whether participants thought the vaccine would negatively impact their health (either short or long term). The model was statistically significant ($X^2(15) = 45.73, p < .001, R^2_{Tjur} = .31$). Education levels ($OR = 3.07, p = .041$), and income levels ($OR = .10, p = .001$) was found to be significant predictors of whether participants thought the vaccine would negatively impact their health (either short or long term). Therefore, the results show that participants with a university degree were more likely to think the COVID-19 vaccination would negatively impact one's health. Lower-income participants were less likely to think the COVID-19 vaccination would negatively impact their health (either short or long term).

The table below is a multiple binary logistic regression model used to examine whether demographic variables and opinions about the vaccine can predict whether participants would recommend the vaccine to others.

Table 13: Logistic Regression Table Predicting whether Participants would Recommend the Vaccine to Others

Term	**OR**	**SE**	**Wald**	**p**	**LLCI**	**ULCI**
Age	0.95	0.03	-1.62	.104	0.90	1.01
Male	0.53	0.65	-0.96	.335	0.14	1.85
University Education	2.43	0.76	1.16	.244	0.59	12.64
Single	5.44	0.81	2.08	**.037**	1.11	28.78
Married	9.45	1.06	2.12	**.034**	1.31	90.40
Living with Partner	12.21	1.05	2.37	**.018**	1.79	127.94
White	0.76	0.72	-0.38	.706	0.17	2.99
Low Income	2.13	0.75	1.01	.313	0.52	10.31
Employed Wages	0.98	0.95	-0.02	.984	0.13	6.05
Student	0.44	1.03	-0.79	.428	0.05	3.19
Vaccine Ineffectiveness	0.97	0.34	-0.09	.924	0.49	1.92
Negative Effects	0.38	0.41	-2.31	**.021**	0.16	0.82
Vaccine Indecision	0.77	0.29	-0.89	.372	0.43	1.35
Social Media Influence	1.60	0.25	1.85	.065	0.98	2.69
Vaccine Inaccessibility	1.63	0.31	1.57	.116	0.91	3.16

Multiple binary logistic regression was conducted to examine if demographic variables and opinions regarding the vaccine predicted whether participants would recommend the vaccine to other people. The model was statistically significant ($X2(15) = 28.10, p = .021, R^2_{Tjur} = .25$). Being single, married, living with one's partner, and opinions towards the negative effects of the vaccine are found to be significant predictors of whether participants would recommend

the vaccine to other people. Therefore, the results show that single participants married and living with their partners are more likely to recommend the vaccine than other marital status groups. Living with a partner seems to have the strongest positive effect on recommending the vaccine. Participants with stronger beliefs about the negative effects of the vaccine are less likely to recommend the vaccine.

Further to these results presented above, appendix B shows the other significant factors which include age, education and employment status. Analysis revealed that the age of the participant is associated with the perceived risk on the dose of vaccine that could cause the longest-lasting or more severe side effects, it is more likely that first dose compared to the booster dose causes more longest-lasting or most severe side effects among those between 18-24 y/o and those between 35-44 y/o. At the same time, the second dose compared to the booster dose is perceived to have more severe side effects among those between 18-24 y/o whilst the third dose was perceived to have cause more severe effect among those between 18-24 y/o, 25-34 y/o and 35-44 y/o. The effect of education on the perception that it is a hard decision for the participant to decide on getting the COVID-19 vaccines or not, the result of the multinomial logistic regression revealed that it is more likely for those who strongly agreed, agreed or were not sure compared to those who strongly disagreed that it is a hard decision to get vaccinated have a postgraduate degree. The result of the multinomial logistic regression also revealed that first dose was more likely to cause more severe side effects among those who are employed and student compared to the booster dose. In the same light, the second dose compared to the booster dose is more likely to cause more severe side effects among the students.

6 Discussion

Several factor can influence individual's perception of risk of COVID-19 vaccines, however risk perception may also differ based on age, gender, education, employment, and marital status etc,. Identifying and understanding these factors play a significant role in fighting current and future pandemics. In this section, the results of the study will be discussed and interpreted in lights of published literature.

Based on the time of the reported risk due to the COVID-19 virus outbreak, individuals perceived different levels of need for protective behavior. As a result of months of coverage, government restrictions, and economic consequences, Norway's residents were informed about the preventive measures they were encouraged to follow (Mangla et al., 2021). The emergence of COVID-19 variants and the expectation of future vaccinations, however, have still caused some individuals to have doubts regarding the information provided and the recommendations from the government (Mangla et al., 2021).

Both male and female Norwegians indicated recommendation from doctors or ministry of health (34.00%) as their primary factor for the uptake of COVID-19 vaccines while other secondary factors include the effectiveness of vaccine (28.67%), concerns on the negative effect of the vaccine on their health (20.67%) and the increasing number of COVID-19 cases (16.67%). Similarly, studies conducted in Sweden, Italy and Taiwan also show that the primary factor that influence the vaccine uptake is the recommendation from authorities followed by lack of knowledge regarding the vaccine and fear of side effects (short term or long term) (Lee et al., 2022; Raffetti et al., 2022).

There is a knowledge gap among Norway's residents' on the changes that could occur in the health of individuals that have taken vaccination; a factor which could be the reason for COVID-19 hesitancy among the participants of this study as more females than males were not certain of possible changes in health condition after vaccination. Statistical analysis also revealed that male are more like to believe that male is less likely to believe that the vaccine has no negative side effects. It is also observed that more females (28.85%) than males (19.28%) are of the opinion that the COVID-19 vaccines are effective, although the level of uncertainty of the

effectiveness of the vaccine was evident among both gender. More females were of the opinion that the first, second and booster dose causes the most severe effects while more male reported that the third dose causes the most severe side effects. Also, more of the married participants compared to the divorced and those leaving with their partners opined that the COVID-19 vaccine is not as effective as it should be. Similarly, (Nordahl, n.d.) also found that female are more likely to experience extreme reactions than male and is less likely to accept the vaccine.

The age of the participant is associated with the perceived risk on the dose of vaccine that could cause the longest-lasting or more severe side effects. It is more likely that first dose compared to the booster dose causes more longest-lasting or most severe side effects among those between 18-24 y/o and those between 35-44 y/o. Similarly, the second dose compared to the booster dose is perceived to have more severe side effects among those between 18-24 years. Whilst the third dose was perceived to have cause more severe effect among those between 18-24 y/o, 25-34 y/o and 35-44 y/o. The first dose was more likely to cause more severe side effects among those who are employed and student compared to the booster dose. In the same light, the second dose compared to the booster dose was more likely to cause more severe side effects among the students. Similarly (Urakawa et al., 2022) found that there is a difference in the severity of reactions according to age-groups and gender, and that females and younger people were more likely to experience severe side effects.

The effectiveness of the COVID-19 vaccines was identified as concerns for those between 35-44 y/o. While among those that were between 45-54 y/o, mainly depend on the recommendation of the vaccines by the doctors and the ministry of health. And for the older participants (54 y/o and above), the risk of unexpected negative effect of the vaccine on them was their major concerns. As observed, some of those above 54 y/o have the perception that their health might change negatively if they take the COVID-19 vaccine, and more participant in this category feels the vaccine might not be effective compared to the younger population. Similarly, (Christensen & Lægreid, 2020) found that there were several doubts about the safety and efficacy of the COVID-19 vaccines, as a result of social media, political organisation and death of health personnel due to blood clots led to reduced trust in the vaccines and the authorities.

The singles expressed the unexpected negative effect of the vaccine on their health as the major factor for COVID-19 vaccine hesitancy, as they also depend on the recommendation from doctor or health ministry, effectiveness of vaccines and recorded cases of COVID-19 cases. Those who declared their interest in accepting all the vaccine compared to those who refuse to accept all vaccines were more likely to be among those employed and the student. Whilst those whose perception is to accept certain vaccines compared to those who refuse to accept all vaccines were more likely among participants who were employed and likewise the students. At the same time, participants who revealed they are not sure but might delay taking vaccine compared to those who refuse to accept all vaccines were more likely to be among the students. Similarly to the study conducted by (Jain et al., 2021) shows that student have a very high acceptance rate and can greatly influence the general population in terms of benefits and positive perception of the vaccine.

More participants between the 45-54 years opined that Facebook and other social media has scary stories on vaccines, which subsequently could hinder the intake of the vaccines, as the visibility of bad personal experiences on social media influences vaccination in Norway (Ebrahimi et al., 2021). Findings revealed that those who agreed compared to disagreed that Facebook and other social media are full of scary stories on vaccination were more likely to be among those with the income more than 300 000 NOK/YR. However, study conducted by (Douglas, 2021) also found that Norway is one of the countries that is least influenced by conspiracy theories that is spread through several platforms due to public's high trust in the government.

Based on racial groups, the non-white residents acceptance (31.71%) to all offered vaccines was lower that the whites' acceptance (44.95%) to all offered vaccines. Among the non-white residents the major factor that influences their decision is vaccine effectiveness (31.71%), where the major factor that influences the whites' is recommendation from the authorities (38.53%). Similarly, (Zickfeld et al., 2020) and (Kraft et al., 2021) established that mistrust in the government and lack of willingness to vaccinate can negatively affect the general public's health during the pandemic, those that were willing to accept certain vaccines compared to those who refuse to accept all vaccines in this study were more likely to be migrant residents.

According to (Kraft et al., 2021), education could influence the decision to take vaccine, in this study, it is more likely that those who strongly agreed, agreed or were not sure compared to those who strongly disagreed that it is a hard decision to get vaccinated have a postgraduate degree. However, Figure 3 also shows that highly educated females are more likely to implement self protective behaviour and Figure 4 illustrates that individual who are above 80 y/o are less likely to implement self protecting behavior. Also, more people with the income of more that 300 000 NOK/YR can easily make decision to get vaccinated, however, more non-white respondents find it harder to decide on taking the COVID-19 vaccines compared to whites'. Those who agreed and strongly agreed that it is a hard decision to either get vaccinated compared to those who strongly disagree were more likely among those non-white residents.

7 Conclusion

The study was conducted to explore the perception of risk for COVID-19 among the Norway's resident. The specific objectives was to describe the pattern of perception of risk for COVID-19 among Norwegian residents. Second, to understand the factors that influence perception of risk for COVID-19 among Norwegian. Lastly to make recommendations to influence vaccine uptake on the current COVID-19 and future pandemics.

Study results show that there are common demographic trends when it comes to factual knowledge about the COVID-19 vaccine and behaviors regarding the vaccine. Compared to ethnic minorities, white participants are less likely to believe the vaccine can alter DNA, and more likely to think everyone, including children, is eligible for the vaccine and more likely to take the vaccine if offered. Participants with university degrees are more likely to believe the vaccine will have negative health implications, whereas participants with Less than 300,000 NOK Income will be the opposite effect. Males and older participants were likelier to believe the vaccine had no side effects.

Along with demographic variables, attitudes and opinions towards the vaccine were associated with participants' vaccine knowledge and vaccine-related behaviors. The stronger participants who believed the vaccine could cause negative side effects on health were less likely to believe the vaccine could protect unvaccinated individuals and recommend the vaccine to others. Overally, the findings show at the risk perception on COVID-19 vaccine has mainly influence by gender, education, location, ethnicity and employment status. Based on the patterns found in this and other research (Raffetti et al., 2022), trust in the government and health authorities' recommendation shows to be the main factor that influences the COVID-19 vaccine uptake.

Statistical interference results found that the non-white participants were less likely to accept all offered vaccine that the whites'. Male, students and highly educated and high income (more than 300 000 NOK/YR) participants were more likely to accept to accept the vaccine, in comparison to female, and low income (less than 300 000 NOK/YR) participants. Based on race, the non-white respondents were less likely to get influenced through scary social media posts regarding the vaccine uptake. Moreover, considering the general opinion of whether the participants who took the vaccine could protect other who didn't take the vaccine was not

statistically significant. And, the knowledge regarding how the COVID-19 vaccine contained inactive corona-viruses that worked as immune stimulates was also not statistically significant. Therefore, this shows that there are some knowledge-gaps surrounding the functionality of the COVID-19 vaccine.

Based on the patterns found in this study, it is further recommended that a better communication and corporation strategies between the government and the general public is required. Moreover, better education, improving integration policy, importance of trust in a reliable source of information, clear and transparent communication and collaboration with the general public is essential. Enhance public trust in the government's recommendations', effective communication regarding the vaccine effectiveness and the importance of understanding the risk perception among different genders, age-groups, education level, location and ethnicity risk perceptions should also be highlighted.

7.1 Future research direction

Future research could investigate, how Norway's authorities can gain more trust across different age-groups, genders, political party followers, location and ethnicity. Further examination of how social media platforms and it's capability to spread false information in order to influence risk perception of vaccine acceptance. Deeper knowledge of which factors can influence risk perception is needed to determine which strategies can be used successfully to influence the general public of vaccine uptake. Risk communication study is also essential to understand how the risk can be effectively communicated. Such research could contribute to identify patterns and strategies that can be used to fight future pandemics. Furthermore, (Bygstad et al., 2022) also recommended on using digital solutions to improve communication and reach different groups in order to fight COVID-19 vaccine hesitancy, which seems as an interesting arena to investigate, considering Norway is technology advanced and considerably digitized country.

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A Survey Questions Used for This Study

Survey name:

Exploring the perception of Covid-19 vaccine benefit/risk

Q1 Do you have a chronic diseases? (SingleSelection)

- Yes
- No

Q2 Do you have the complete information regarding the covid-19 vaccine? (SingleSelection)

- Yes
- No
- I have some but not completely

Q3 Do you live outside the major cities in Norway (i.e. Oslo, Bergen, Trondheim, Stavanger, Kristiansand) ? (SingleSelection)

- Yes
- No

Q4 Did you know that the vaccines against COVID-19 contain inactivated Coronaviruses that work as immune stimulators? (SingleSelection)

- Yes
- No

Q5 Do you think that the COVID-19 vaccines can change or interact with your DNA in any way? (SingleSelection)

- Yes
- No

Q6 Did you know that everyone including children can receive COVID-19 vaccination? (SingleSelection)

- Yes
- No

Q7 Do you think that the COVID-19 vaccine can also protect us from influenza? (SingleSelection)

- Yes
- No
- Maybe

Q8 Do you think that the COVID-19 vaccine can protect other people who did not receive vaccination? (SingleSelection)

- Yes
- No
- Maybe

Q9 Do you think that the COVID-19 Vaccine do not have side effects? (SingleSelection)

- Yes
- No
- Maybe

Q10 Would you recommend others to get vaccinated (SingleSelection)

- Yes
- No
- It depends on the individuals background (Age, health status, etc.)

Q11 What are the factors that can influence your decision to take COVID-19 Vaccine (SingleSelection)

- Vaccine effectiveness
- Recomendation from doctors or ministry of health
- Amount of increasing positive COVID-19 cases
- Unexpected negative effects on your health

Q12 Do you think that your health will change negatively after getting the COVID-19 vaccine? (SingleSelection)

- Yes, inegatively and for a long term
- Yes, negatively but for a short term only
- I am not sure
- No, positively but i am not sure
- No, it will not change at all

Q13 In my opinion, the vaccine may not be as effective as it should be (SingleSelection)

- Strongly agree
- Agree
- I am not sure
- Disagree
- Strongly disagree

Q14 The vaccination may cause unexpected negative effects, which I am concerned about (SingleSelection)

- Strongly agree
- Agree
- I am not sure
- Disagree
- Strongly disagree

Q15 It's hard for me to decide whether I should get vaccinated or not (SingleSelection)

- Strongly agree
- Agree
- I am not sure
- Disagree
- Strongly disagree

Q16 Facebook and other social media are full of scare stories about vaccines (SingleSelection)

- Strongly agree
- Agree
- I am not sure
- Disagree
- Strongly disagree

Q17 Vaccinations may not be available at nearby clinics or vaccination centers due to high demand (SingleSelection)

- Strongly agree
- Agree
- I am not sure
- Disagree
- Strongly disagree

Q18 In the event of infection with Covid-19 after getting vaccinated, how likely do you expect your illness due to side effects to increase? (SingleSelection)

- Less than 50%
- More than 50%
- No difference

Q19 Which dose of vaccine can cause the longest-lasting or most severe side effects? (SingleSelection)

- First dose
- Second dose
- Third dose
- Booster dose

Q20 Are you willing to get vaccinated if the vaccine is offered for you? (SingleSelection)

- Yes, I will accept all vaccines
- Yes, I will accept certain vaccines, but i am not sure
- I am not sure, I might delay on taking the vaccine
- No, I might refuse, but i am not sure
- No, I refuse to accept all vaccines

B Furthermore, Multiple logistic regression analysis

Effect of Age on the Perception that in the event of infection with Covid-19 after getting vaccinated, how likely do you expect your illness due to side effects to increase

Q18.In the event of infection with Covid-19 after getting vaccinated, how likely do y[a]		B	Std. Error	Wald	df	Sig.	Exp(B)
Less than 50%	Intercept	.000	.816	.000	1	1.000	
	[Age_=1]	.288	.885	.106	1	.745	1.333
	[Age_=2]	-.383	.882	.188	1	.664	.682
	[Age_=3]	-.336	.915	.135	1	.713	.714
	[Age_=4]	1.099	1.054	1.086	1	.297	3.000
	[Age_=5]	0[b]			0		
More than 50%	Intercept	.000	.816	.000	1	1.000	
	[Age_=1]	.125	.890	.020	1	.888	1.133
	[Age_=2]	-1.299	.937	1.921	1	.166	.273
	[Age_=3]	-.336	.915	.135	1	.713	.714
	[Age_=4]	-20.396	0.000		1		1.387E-09
	[Age_=5]	0[b]			0		

a. The reference category is: No difference.

Effect of Age on the Perceived risk on the dose of vaccine that can cause the longest-lasting or most severe side effects

Q19.Which dose of vaccine can cause the longest-lasting or most severe side effects?[a]		B	Std. Error	Wald	df	Sig.	Exp(B)
First dose	Intercept	-.916	.837	1.199	1	.273	
	[Age_=1]	**3.114**	**1.121**	**7.721**	**1**	**.005**	**22.500**
	[Age_=2]	1.322	.953	1.923	1	.165	3.750
	[Age_=3]	**2.015**	**.983**	**4.200**	**1**	**.040**	**7.500**
	[Age_=4]	2.015	1.169	2.971	1	.085	7.500
	[Age_=5]	0[b]			0		
Second dose	Intercept	-.916	.837	1.199	1	.273	
	[Age_=1]	**3.314**	**1.116**	**8.819**	**1**	**.003**	27.500
	[Age_=2]	1.609	.942	2.919	1	.088	5.000
	[Age_=3]	1.386	1.012	1.875	1	.171	4.000
	[Age_=4]	.916	1.304	.494	1	.482	2.500
	[Age_=5]	0[b]			0		
Third dose	Intercept	-19.740	1.000	389.662	1	.000	
	[Age_=1]	**21.349**	**1.265**	**284.870**	**1**	**.000**	1870176225.399
	[Age_=2]	**19.606**	**1.126**	**303.195**	**1**	**.000**	327280839.465
	[Age_=3]	**19.922**	**1.169**	**290.410**	**1**	**.000**	448842294.124
	[Age_=4]	19.740	0.000		1		374035245.098
	[Age_=5]	0[b]			0		

a. The reference category is: Booster dose.

Effect of Education on the perception that is hard to decide on either to get vaccinated or not

Q15. It's hard for me to decide whether I should get vaccinated or not[a]		B	Std. Error	Wald	df	Sig.	Exp(B)
Strongly agree	Intercept	-2.197	1.054	4.345	1	.037	
	[Education=2]	1.186	1.205	.968	1	.325	3.273
	[Education=3]	1.099	1.563	.494	1	.482	3.000
	[Education=4]	20.281	1.514	179.489	1	.000	642725271.765
	[Education=5]	.300	1.222	.060	1	.806	1.350
	[Education=6]	0[b]			0		
Agree	Intercept	-2.197	1.054	4.345	1	.037	
	[Education=2]	2.102	1.141	3.393	1	.065	8.182
	[Education=3]	2.197	1.333	2.716	1	.099	9.000
	[Education=4]	20.281	1.514	179.489	1	.000	642725271.755
	[Education=5]	1.686	1.116	2.285	1	.131	5.400
	[Education=6]	0[b]			0		
I am not sure	Intercept	-1.099	.667	2.716	1	.099	
	[Education=2]	.780	.813	.922	1	.337	2.182
	[Education=3]	1.792	.972	3.399	1	.065	6.000
	[Education=4]	20.281	.979	429.212	1	.000	642725271.765
	[Education=5]	-.105	.813	.017	1	.897	.900
	[Education=6]	0[b]			0		
Disagree	Intercept	-.405	.527	.592	1	.442	
	[Education=2]	.780	.657	1.412	1	.235	2.182
	[Education=3]	-.693	1.269	.298	1	.585	.500
	[Education=4]	20.569	0.000		1		856967029.020
	[Education=5]	-.025	.636	.002	1	.968	.975
	[Education=6]	0[b]			0		

a. The reference category is: Strongly disagree.

Effect of Employment on the perception that dose of vaccine can cause the longest-lasting or most severe side effect.

Q19.Which dose of vaccine can cause the longest-lasting or most severe side effects?[a]		B	Std. Error	Wald	df	Sig.	Exp(B)
First dose	Intercept	-.560	.627	.797	1	.372	
	[Employment_Status=1]	**1.684**	**.703**	**5.728**	**1**	**.017**	5.385
	[Employment_Status=7]	**2.064**	**1.002**	**4.242**	**1**	**.039**	7.875
	[Employment_Status=9]	0[b]			0		
Second dose	Intercept	-.154	.556	.077	1	.782	
	[Employment_Status=1]	.990	.648	2.337	1	.126	2.692
	[Employment_Status=7]	**2.100**	**.939**	**5.006**	**1**	**.025**	8.167
	[Employment_Status=9]	0[b]			0		
Third dose	Intercept	-.560	.627	.797	1	.372	
	[Employment_Status=1]	.634	.736	.742	1	.389	1.885
	[Employment_Status=7]	1.812	1.018	3.171	1	.075	6.125
	[Employment_Status=9]	0[b]			0		

a. The reference category is: Booster dose.

Effect of Employment on the uptake of Covid-19 Vaccine

Q20.Are you willing to get vaccinated if the vaccine is offered for you?[a]		B	Std. Error	Wald	df	Sig.	Exp(B)
Yes, I will accept all vaccines	Intercept	.288	.764	.142	1	.706	
	[Employment_Status=1]	**2.826**	**1.051**	**7.223**	**1**	**.007**	16.875
	[Employment_Status=7]	**20.235**	**.997**	**412.106**	**1**	.000	613820447.809
	[Employment_Status=9]	0[b]			0		
Yes, I will accept certain vaccines, but i am not sure	Intercept	.511	.730	.489	1	.484	
	[Employment_Status=1]	2.262	1.032	4.805	1	.028	9.600
	[Employment_Status=7]	**19.845**	**.979**	**411.273**	**1**	**.000**	415509226.209
	[Employment_Status=9]	0[b]			0		
I am not sure, I might delay on taking the vaccine	Intercept	.693	.707	.961	1	.327	
	[Employment_Status=1]	.811	1.054	.592	1	.442	2.250
	[Employment_Status=7]	**18.874**	**1.017**	**344.745**	**1**	**.000**	157389858.412
	[Employment_Status=9]	0[b]			0		
No, I might refuse, but i am not sure	Intercept	.000	.816	.000	1	1.000	
	[Employment_Status=1]	1.504	1.130	1.770	1	.183	4.500
	[Employment_Status=7]	19.057	0.000		1		188867830.095
	[Employment_Status=9]	0[b]			0		

a. The reference category is: No, I refuse to accept all vaccines.

Effect on income on willingness to get COVID-19 Vaccines

Q20.Are you willing to get vaccinated if the vaccine is offered for you?[a]		B	Std. Error	Wald	df	Sig.	Exp(B)
Yes, I will accept all vaccines	Intercept	19.624	4362.524	.000	1	.996	
	[Income=1]	.255	8970.065	.000	1	1.000	1.291
	[Income=2]	.664	10557.910	.000	1	1.000	1.942
	[Income=3]	-17.678	4362.524	.000	1	.997	2.101E-08
	[Income=4]	-17.920	4362.524	.000	1	.997	1.651E-08
	[Income=5]	-19.219	4362.524	.000	1	.996	4.502E-09
	[Income=6]	-.316	7028.083	.000	1	1.000	.729
	[Income=7]	.146	1.245	.014	1	.907	1.157
	[Income=8]	0[c]			0		
Yes, I will accept certain vaccines, but i am not sure	Intercept	19.337	4362.524	.000	1	.996	
	[Income=1]	-.017	8970.065	.000	1	1.000	.983
	[Income=2]	-17.075	11004.471	.000	1	.999	3.841E-08
	[Income=3]	-17.545	4362.524	.000	1	.997	2.401E-08
	[Income=4]	-18.084	4362.524	.000	1	.997	1.401E-08
	[Income=5]	-18.643	4362.524	.000	1	.997	8.003E-09
	[Income=6]	.531	7028.083	.000	1	1.000	1.701
	[Income=7]	-.019	1.282	.000	1	.988	.982
	[Income=8]	0[c]			0		
I am not sure, I might delay on taking the vaccine	Intercept	18.643	4362.524	.000	1	.997	
	[Income=1]	-.017	8970.065	.000	1	1.000	.983
	[Income=2]	.797	10557.910	.000	1	1.000	2.219
	[Income=3]	-34.988	5618.784	.000	1	.995	6.382E-16
	[Income=4]	-17.727	4362.524	.000	1	.997	2.001E-08
	[Income=5]	-18.643	4362.524	.000	1	.997	8.003E-09
	[Income=6]	-.028	7028.083	.000	1	1.000	.972
	[Income=7]	-1.271	1.633	.606	1	.436	.280
	[Income=8]	0[c]			0		
No, I might refuse, but i am not sure	Intercept	17.545	4362.524	.000	1	.997	
	[Income=1]	-16.446	10046.835	.000	1	.999	7.203E-08
	[Income=2]	.797	10557.910	.000	1	1.000	2.219
	[Income=3]	-16.852	4362.524	.000	1	.997	4.802E-08
	[Income=4]	-16.629	4362.524	.000	1	.997	6.002E-08
	[Income=5]	-17.545	4362.524	.000	1	.997	2.401E-08
	[Income=6]	-.316	7028.083	.000	1	1.000	.729
	[Income=7]	.926	0.000		1		2.524
	[Income=8]	0[c]			0		

a. The reference category is: No, I refuse to accept all vaccines.