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Which Factors are Associated with a SARS-CoV-2 Vaccination Readiness in Germany?

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# Vorwort

Die Prüfungsleistung im Modul 11-M-66-1-M6 erfolgt in Form eines Publikationsmanuskripts. Hierfür wurde das Journal "Frontiers of Public Health" ausgewählt.

Im Folgenden wird zunächst der Text für das Publikationsmanuskript, entsprechend der Autorenhinweise der Zeitschrift "Frontiers of Public Health", dargestellt. Im Anschluss folgt ein separater Anhang, der lediglich für die vorliegende Prüfungsleistung relevant ist. Dieser Anhang enthält xxx für das vorliegende Forschungsprojekt.

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**Which Factors are Associated with a SARS-CoV-2 Vaccination Readiness in Germany?**

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# Abstract

**Introduction:** Global acceptance of an effective vaccine is currently the most probable solution to combat the SARS-CoV-2 pandemic. This study was conducted to identify and assess factors that influence the vaccination readiness of the German public during the pandemic as well as to provide evidence that could be used to ultimately remove obstacles preventing high vaccination coverage and, by extension, herd immunity.

**Methods:**. A cross-sectional online survey was conducted between August 1 and November 1, 2021, throughout Germany. Participants were asked about their SARS-CoV-2 vaccination status as well as their motivations to receive or not to receive the vaccination.A logistic regression model was used to assess the association between socio-economic characteristics, sources of information concerning the pandemic and vaccines, trust in health services and vaccination readiness.

**Results:** Eight factors showed a statistically significant influence on vaccination readiness. Those factors were: sex, persons per household, the highest educational attainment, low trust in government healthcare agencies, information sources, the personal information interval and previous vaccination participation.

**Discussion:**

# INTRODUCTION

The current 2019 coronavirus pandemic (Covid-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) threatens and affects lives worldwide. In the context of the SARS-CoV-2 pandemic, vaccination is being discussed as essential in the effort to contain the incidence of infection (3). The status as of XX/XX/XXXX shows that nationwide XX % of the German population are fully vaccinated (4). Because of the importance of the issue, numerous studies address SARS-CoV-2 and the implications associated with public engagement in vaccination. Because of the importance of the issue, numerous studies address SARS-CoV-2 and the implications associated with public participation in vaccination. Although there has been a wait for a vaccine against the virus since the beginning of the pandemic and a high level of vaccination participation was assumed due to the High level of interest in the population, vaccination readiness in Germany was very low compared to neighboring countries (1).

Several studies with different focuses have already been conducted on vaccination preparedness during a pandemic. To provide an overview of the current state of research, the results of some studies are briefly highlighted below. With regards to anxiety, it has often been reported to be associated with both positive and negative vaccinationreadiness. Benau et al. (2021) showed that Covid-19-related anxiety are associated with a positive vaccination readiness (2). On the other hand, several studies showed that social and economic fears are associated with negative vaccination readiness (3,4).

In addition, there is several evidence regarding the impact of sociodemographic factors on vaccine readiness. In terms of gender, studies have shown that men could be more likely to get vaccinated than woman of the same age (5–7). Furthermore, some studies show that people with high age and high education are more likely to get vaccinated (6,7). Betsch et al. (2021) showed that people with low education are less interested in getting a Covid-19 vaccination (5). Another study showed that people who perceive a high risk of disease or high susceptibility to Covid-19 are more likely to participate in a vaccination program (8). Conversely, people are more likely to decline vaccination if they do not know anyone who already had Covid-19 (5). It is often assumed that knowledge about herd immunity increases the likelihood of getting vaccinated (9). Similarly, a lack of information about herd immunity and vaccination could be one of the main reasons for low vaccination adherence (10). Overall, it can be assumed that there is a relationship between information-seeking behaviors as well as vaccination knowledge and vaccination readiness or refusal (10,11). This information is complemented by evidence stating that a higher level of trust in the government, the direct approach to the population and clear transparent communication have a positive effect on vaccination participation (7,8). Conversely, dissatisfaction regarding the government, concerns about vaccine safety and efficacy, and misinformation about Covid-19 vaccines regarding safety are associated with negative vaccination attitudes (4,6,8). Furthermore, health care professionals (HCPs) are also thought to influence vaccination readiness (12–14). Maurer et al. (2010) (15) and Schwarzinger et al. (2010) (16) describe that individuals who received information from a HCP were more likely to get vaccinated and in addition, vaccination readiness increased as a result of HCP recommendations. In general, however, it can be said that employment in health care, is both positively and negatively associated with a Covid-19 vaccination readiness (6–8,17).

Vaccinations are one of the most effective agents when it comes to preventing the overburdening of the health care system as well as an increase in mortality as a result of severe Covid-19 cases (3). Moreover, it seems likely that detecting factors connected to vaccination readiness would be a distinct advantage for future health communication. On that account, this paper reports the results obtained from the COVIM online survey, in which people at the age of majority in Germany answered questions on specific topics that can be linked to the SARS-CoV-2 pandemic. This survey was design to identify factors associated with vaccination readiness and therefore to determine differences in vaccination readiness or refusal.

# METHODS

## **Design and sample**

Due to the actuality of the topic of which factors are associated with a SARS-CoV-2 vaccination readiness, literature research was conducted on comparable vaccinations such as influenza and measles to create the questionnaire. The results as well as potential confounding factors regarding the study outcome are shown in the direct cyclic graph (DAG). This study is based on a cross-sectional online survey conducted between August 1 and November 1, 2021. The target population was the adult population of Germany. The online survey was published on commonly used social networks (Facebook, Telegram and WhatsApp) as well as other public platforms In addition, posters with a QR code were put up in frequently visited public places such as student residences, blood donation centers, or canteens to encourage participation in the survey. The following cites were considered: Berlin, Bielefeld, Bremen, Dresden Frankfurt, Hamburg.

To collect the information, a series of questions were designed and developed based on the previous literature research on factors associated with other vaccinations such as influenza and measles. The questions were first pre-tested and were revised and finalized on feedback from pre-testers. Before the activation of the questionnaire, a sample size calculation was performed to estimate the number of participants needed to obtain statistically significant results.

## **Study Variables**

At the time of data collection (August 1 to November 1, 2021), not all participants had already received an . Therefore the outcome variable is defined as the attitude towards a SARS-CoV-2 vaccination and consists of having already got vaccinated or wanting to get vaccinated. In addition, participants were asked for their motivation to get vaccinated or not to get vaccinated, respectively.

To explore possible factors associated with a SARS-CoV-2 vaccination readiness, participants were asked about their trust in as well as their attitude towards the German health care system, sources of information about the vaccination, political attitude, the current mental and physical state of health, migration background and the current vaccination status (apart from SARS-CoV-2). In addition sociodemographic characteristics including age, gender, educational attainment, occupation, marital status and monthly income were collected.

Age was grouped into 5 groups (18-25, 26-35, 36-45, 46-55, 56-73); educational attainment was grouped into no graduation, major school diploma, secondary school diploma and high school diploma (A-level); employment status was grouped into not employed, full-time employed, part-time employed, self-employed, student, apprenticeship, pupil, internship, pension and marginal employment; monthly income was grouped into 9 groups (under 500€, 500 up to 1000€, 1000 up to 1500€ 1500 up to 2000€, 2000 up to 3000€, 3000 up to 4000€, 4000 up to 5000€, 5000 up to 6000€, more than 6000€). A score was formed to measure the trust in the German health care system. For example, participants were asked using a likert scale how much trust they have in their doctor (the doctor is assessed here as a representative of the health system) and how they rate the quality of treatment. Trust in institutions such as the Robert Koch Institute (RKI) or the Paul Ehrlich Institute (PEI) as part of the health care system as well as political actions were also questioned through a likert scale. The lower the score, the higher the trust in the health care system. Respondents were also asked whether they were working in the health sector or not.

## **Data Preparation**

A total of 1131 persons participated in this study. Out of the 1131, 234 were excluded due to stopping the questionnaire prematurely. Three were excluded because they filled out the questionnaire intending to manipulate the survey. After excluding those 237 persons, the study population consists out of 897 persons, of which 424 were eligible for the multivariable regression and 261 for the sensitivity analysis (Figure X).

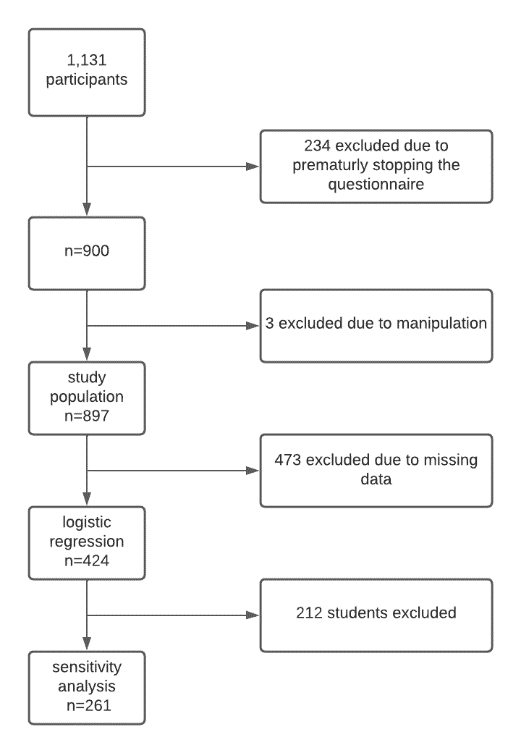


Figure 1: flow chart of the study population

## **Statistical Analysis**

All statistical analyses were performed in duplicate in SAS 9.4 and R 4.1.1. First, the dependent variable, the attitude towards SARS-CoV-2 vaccination was defined. Having a positive attitude towards the SARS-CoV-2 vaccination was defined as being vaccinated or wanting to get vaccinated. A complete case binary logistic regression was used to access which factors may influence this variable. The outcome of the logistic regression was a negative attitude towards the vaccination. The only forms of imputation used were those which occur when building scores. Therefore only 424 out of 897 individuals were included in the multivariable analysis, due to missing data. The variable selection used was a p-value driven stepwise variable selection. Variables were included in the model if the p-value was below 0.1 when entering the model and they stayed if the p-value did not increase above 0.2 in the following steps (Table X). The level of significance was set to 5%. Subsequently, a sensitivity analysis was performed, which used the same structure for the logistic regression but excluded all students from the study population (Appendix X).

## **Ethical Approval**

This study was conducted as part of a student research project. Thus, there is no opportunity to obtain an ethics vote for the survey and to publish the obtained results. All participants’ data were collected anonymously. This means that they cannot be re-identified. Participants were informed about data protection guidelines and the disclosure of their data before participating in the study. Participant data were stored in a password-protected manner during the study so that only the researchers have access to the data. Due to anonymizing the personal data, subsequent deletion is no longer possible. In addition to the General Data Protection Regulation (GDPR), general human rights and the Charter of fundamental rights of the European Union were also respected when handling the data. To verify the age of the majority, the age of the participants was also requested at the beginning of the questionnaire.

# RESULTS

Survey respondents represented a random sample of the populations of all states in Germany that comprise around 0.00108% of the German population. A non-probabilistic quota sample representing the adult general population for the characteristics age, sex and state. The final sample consisting out of 897 participants and is divided into 244 (27.17%) males, 644 (71.71%) females and 9 (1.11%) diverse. Their characteristics and a summary of their responses to the survey questions are listed in Table X (and Appendix X). An overall rejection of SARS-CoV-2 vaccination was nearly the same among women (11.02%) and men (12.70%).

Table X: Study characteristics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Male  (n=244) | Female (n=644) | Diverse (n=9) | Overall  (N=897) |
| Age |  | **M (SD)** | **M (SD)** | **M (SD)** | **M (SD)** |
|  |  | 31.29 (12.53) | 28.73 (10.71) | 29.11 (10.52) | 29.50 (11.34) |
|  |  | **N (%)** | **N (%)** | **N (%)** | **N (%)** |
|  | 18 - 25 | 103 (42.21) | 350 (54.35) | 5 (55.56) | 458 (51.06) |
|  | 26 - 35 | 83 (34.02) | 190 (29.50) | 3 (33.33) | 276 (30.77) |
|  | 36 - 45 | 21 (8.61) | 41 (6.37) |  | 62 (6.91) |
|  | 46 - 55 | 17 (6.97) | 29 (4.50) |  | 46 (5.13) |
|  | 56 - 73 | 20 (8.20) | 34 (5.28) | 1 (11.11) | 55 (6.13 |
| Marital status |  |  |  |  |  |
|  | Single | 169 (77.88) | 480 (81.49) | 7 (87.50) | 656 (80.59) |
|  | Married | 39 (17.97) | 94 (15.96) | 1 (12.50) | 134 (16.46) |
|  | Divorced | 8 (3.69) | 14 (2.38) | - | 22 (2.70) |
|  | Widowed | 1 (0.46) | 1 (0.17) | - | 2 (0.25) |
| Migration background |  |  |  |  |  |
|  | Migration background | 36 (14.75) | 90 (13.98) | 1 (11.11) | 127 (14.16) |
|  | No migration background | 208 (85.25) | 554 (86.02) | 8 (88.89) | 770 (85.84) |
| Graduation |  |  |  |  |  |
|  | No graduation |  |  |  |  |
|  | major school diploma (Hauptschulabschluss) | 7 (3.18) | 4 (0.67) |  | 11 (1.34) |
|  | secondary school diploma (Realschulabschluss) | 19 (8.64) | 37 (6.24) |  | 56 (6.82) |
|  | high school diploma (A-level) (Abitur) | 194 (88.18) | 552 (93.09) | 8 (100.0) | 754 (91.84) |
| Employment status |  |  |  |  |  |
|  | Not employed | 16 (7.96) | 35 (6.88) | 2 (33.33) | 53 (7.40) |
|  | Full-time employed | 70 (34.83) | 104 (20.43) |  | 174 (24.30) |
|  | Part-time employed | 15 (7.46) | 75 (14.73) |  | 90 (12.57) |
|  | Self-employed | 14 (6.97) | 17 (3.34) |  | 31 (4.33) |
|  | Student | 59 (29.35) | 210 (41.26) | 3 (50.00) | 272 (37.99) |
|  | Apprenticeship | 6 (2.99) | 9 (1.77) |  | 15 (2.09) |
|  | Pupil | 3 (1.49) | 1 (0.20) |  | 4 (0.56) |
|  | Internship | 1 (0.50) | 3 (0.59) |  | 4 (0.56) |
|  | Pension | 6 (2.99 | 9 (1.77) | 1 (16.67) | 16 (2.23) |
|  | Marginal employment | 11 (5.47) | 46 (9.04) |  | 57 (7.96) |

Other reasons for a positive vaccination readiness could be the following: single persons in relation to marital status (91.78%) compared to and divorced people (86.36%) and married (77.78%); participants without a migration background (94.60%) compared to people with a migration background (87.50%); people with a high school diploma (A-level (Abitur)) (90.34%) compared to people with a major school diploma (Hauptschulabschluss) (81,82%) and secondary school diploma (Realschulabschluss) (69.64%).

Overall 85.00% of the participants had been vaccinated at least once, the distribution of the number of vaccinations as well as the vaccine manufacturers are described in figure X. At the time of the survey, 80.00% knew a person infected with Covid-19 and 35.00% of them had a severe course of SARS-CoV-2.

Figure 2: Total vaccine by manufacturer

Respondents from Lower Saxony gave the highest proportion of positive responses on vaccination readiness (245 of 265 respondents, 92.45 %). In contrasts, respondents from Bavaria reported the highest proportion of negative responses on vaccination readiness (8 of 16 respondents, 33.33%).

The most common reason given for vaccination consent is that the risk of infection is too high (94.34%). Getting vaccinated for family reasons (94.22 %) and or social reasons (92.20 %), as well as the argument of returning to everyday life (91.58%), also have a high level of acceptance among the respondents who have been vaccinated. 88.30% have been vaccinated to reduce the burden on the health system and about half have been vaccinated for professional reasons (49.31%). About one-third stated that they have been vaccinated due to their social environment (32.46%).

The most frequent reason for vaccination rejection is doubt about the safety of the vaccine (82.00%) followed by fear of side effects (60.00%). 55.00% of participants who have not been vaccinated consider their health status to be good enough so that no vaccination is needed. About a half of the study population had doubts about the effectiveness of the vaccine (46.00%) and 39.00% felt that the Covid-19-reporting is inadequate. Other reasons for not vaccinating were allergic reactions to other vaccines (7.00%), social influence on the decision to vaccinate (5.00%), poor health condition (4.00%), being pregnant or breastfeeding (2.00%), getting another vaccine in a timely manner (1.00%) and or not having access to the desired vaccine (1.00%).

The logistic regression (Table X) shows that gender plays an important role in vaccination readiness, with women nine times more likely to be unvaccinated than men in our survey(OR = 9.022; CI (95%) = 1.896-42.928). The probability for a positive attitude towards vaccination increases with each additional person in the household (OR = 1.452; CI (95%) = 1.032-2.042). How information is acquired also plays a role in vaccination readiness. People who regularly inform themselves about SARS-CoV-2 have a higher chance of not getting vaccinated compared to those who rarely or never inform themselves about the virus (OR = 5.896; CI (95%) = 1.483-23.435). The use of newspapers and magazines as a medium of information increases the likelihood of not getting vaccinated. The more newspapers and magazines read, the greater the protective factor for not getting vaccinated (OR = 0.156; CI (95%) = 0.052-0.472). Furthermore, trust in healthcare agencies and institutions is negatively associated with vaccination readiness. The likelyhood of not being vaccinated or wanting to be vaccinated against SARS-CoV-2 are approximately eight times higher if one has not been vaccinated against rubella (OR = 8.837; CI (95%) = 1.804-43.886), than if one have been vaccinated against the disease at least once.

Table X: Univariate and multivariate analysis about associations between attitude towards vaccination and different possible

predictors.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Bivariate Analysis (n=424) | | | Multivariable Analysis (n=424) | | |
| Variable | Odds Ratio | CI (95%) | Odds Ratio | | CI (95%) | |
|  |  |  |  | |  | |
| Gender: Female | 1.328 | 0.560-3.152 | 9.022 | | 1.896-42.928 | |
| Persons per household | 1.143 | 0.926-1.410 | 1.452 | | 1.032-2.042 | |
| Highest educational attainment: “beruflich-betriebliche Ausbildung“ | 4.552 | 2.198-9.427 | 8.693 | | 2.297-32.898 | |
| Net income higher than 1.500 Euro | 3.248 | 1.531-6.890 | 3.537 | | 0.954-13.122 | |
| AFD for the next election | 69.643 | 7.865-616.702 | 16.182 | | 0.355-737.155 | |
| Low trust government healthcare agencies | 17.832 | 8.278-38.412 | 47.388 | | 12.801-175.424 | |
| Source of information: Newspaper | 0.402 | 0.220-0.734 | 0.156 | | 0.052-0.472 | |
| Searching for information about corona >2 times a week | 1.648 | 1.106-2.454 | 5.896 | | 1.483-23.435 | |
| Knowing no person who already had corona | 3.6 | 1.361-9.525 | 4.192 | | 0.952-18.455 | |
| Never received a influenza vaccination | 2.287 | 0.969-5.400 | 3.972 | | 0.999-15.784 | |
| Never received a rubella vaccination | 4.355 | 1.862-10.183 | 8.837 | | 1.804-43.286 | |
|  |  |  |  | |  |

## **Sensitivity Analysis**

The results of the sensitivity analysis (Appendix X) showed similar results to the main model. The logistic regression model of the sensitivity analysis did not include the variables: sex, persons per household, highest educational attainment, and the net income above 1500 euros. All other variables stayed in the model and remained a similar odds ratio. The only other difference is that the influence of receiving an influenza vaccination gets statistically significant (OR = 7.292; CI (95%) = 1.166-45.596).

# DISCUSSION

# Developing vaccines against Covid -19 and making them accessible worldwide is a priority to end the pandemic. However, the success of this approach depends on people's readiness to be vaccinated. This vaccination readiness is a crucial factor of vaccination behavior, which why it is related to the success of vaccination programs (18). Hence, understanding individual differences in vaccination readiness and its influencing factors is most important. The results of the COVIM online survey show, that multiple factors influence one´s readiness to be vaccinated. Overall, eleven variables were identified as influencingvaccination readiness, of which seven in turn were statistically significant.

## **Results**

A factor that could potentially negatively influenced attitudes toward vaccination is gender. As already seen in many studies, being a woman increases the chances of having a negative vaccination readiness. It could be assumed that because vaccination reaction as well as allergic reaction are more likely to occur in women, that they are hesitant about vaccination. Also, the later recommendation to get vaccinated for pregnant and breastfeeding women from the Standing Committee on Vaccination (STIKO), which was published during the study period, could be a reason for a lower vaccination readiness in women.

The attitude towards politics can be also identified as an influencing factor for vaccination readiness. The results in the bivariate model show that people who would vote for the AFD (alternative for Germany, right wing party) show a significantly lower propensity to vaccinate in next Sunday's elections. The AFD is known for being a party critical of vaccination which could be reflected in their voters. Being critical against health care system/organizations influenced vaccination readiness. Especially the In particular, poor prepareness for a pandemic and mistakes in pandemic policy have weakened the public confidence.

An important role in vaccination readiness plays the factor of how and where information about SARS-CoV-2 and its´ vaccination are searched for. An active search for information and the sources of information chosen are deliberate. This is why the probability of false knowledge could be increased and therefore a negative attitude towards vaccination could grow. Strong need for information and deliberation are not associated with better numerical understanding and the ability to handle and understand information and findings well is not automatically associated with an active seeking. In this context, the results of this survey on having an increasingly negative vaccination readiness if someone is searching for information more than two times a week can be discussed. Furthermore, if the chosen information source is newspapers, the negative vaccination readiness decreases. The medium Newspaper has been described as local/regional, national, international newspaper as well as yellow press. No so-called alternative newspaper were included, which is why the probability of false information on SARS-CoV-2 should be low. A positive effect on vaccination readiness may also be shown if a person has already had positive vaccination experiences, as shown in the results show for people who have already received a vaccination against rubella.

The results of the COVIMO study – COVID -19 Vaccination Rate Monitoring in Germany, describe that individuals with school and vocational qualifications that include upper secondary and post-secondary non-tertiary education (e.g., (specialized) university entrance qualification and apprenticeship training, completion of a 2- or 3-year course of education) have a lower propensity to be vaccinated. The same results can be seen in this study. People whose highest educational attainment is industrial training (“beruflich-betriebliche Ausbildung“) are more likely to have lower vaccination readiness.

A higher negative vaccination readiness of people with a net income of more than 1500€ is seen in the survey. A reason for this association could be, that most of the study population are students. Students have an average monthly income of about 1000€, that’s why they are not included in the described group. Because of the population sample, which has a high rate of younger people and students, it can be assumed, that this population group is more likely to live in shared apartments and therefore, live with at least one other person in one household.

Overall, Similar results, as mentioned above, were found in representative studies on vaccination readiness for the SASRS-CoV-2 vaccine, like the COSMO — COVID-19 Snapshot Monitoring of the University of Erfurt, which started in December 2021 and the COVIMO - COVID-19 vaccination rates -Monitoring in Germany, which started in January 2021.

**Bias**

Due to the online recruitment, a selection bias could not be avoided. Therefore, people with an affinity for media or the topic of the study and those with easier internet access were more likely to participate (repeatedly) in the survey. In addition, due to self-selection, volunteers are more motivated than randomly selected individuals, and therefore volunteer bias should be taken into account. Thus, the data represent only a subset of the population, and are therefore not generalizable to the general population.

# **Limitations**

# This cross-sectional study represents a snapshot at the time of the survey, within a short survey period. However, the Covid-19 pandemic is a dynamic event, vaccination readiness changes, as do infection incidence, risk assessment, and other attitudes in the context of the Covid-19 pandemic. The survey reported in the present study shows the status before the start of the fifth Sars-CoV-2 wave (omicron), where the delta variant was the dominating Sars-CoV-2 variant. Comparability with current research is limited because factors related to the context mentioned above may have changed or new ones may have been added. Consequently, the results of other studies could differ, and comparability is difficult. In addition, the sample size of approximately 897 respondents allows and subgroup analyses are not possible due to limited representativeness and sample size. Furthermore, the cross-sectional observational data in this study does not allow for causal inference or determination of timing and associations between different variables.

# According to the selection bias described above the study population in the present study is not a representative sample reflecting the general German population. Less than one third of the recruited persons were male participants, therefore no conclusions about the influence of gender on the readiness to be vaccinated can be drawn. 38% of the participants were students, more than 90% indicated to have a high school diploma (A-Levels / Abitur) and over 80% of the sample fell into the young age categories (18-25 y, 26-35 y). Hence, the measured sociodemographic characteristics are not representative of the general German population. A more heterogeneous sample is necessary to determine representative factors that influence vaccination attitudes valid for the general population. In addition, the proportion of those participants vaccinated at least once is higher than the proportion of unvaccinated participants. Therefore the sample from the COVIM-Study could be thinking more positively about vaccinations than the general German population. Thus the proportion of those willing to be vaccinated could be overestimated and thus the achievable vaccination rate, could be overestimated.

# **Ende**

# The challenge is to get the undecided and hesitant citizens to vaccinate so that the threshold of herd immunity is crossed. Therefore, it is necessary to search for effective strategies to increase vaccination coverage among undecided and skeptical citizens. Because many studies of Covid-19 vaccine readiness have linked information influence to vaccination, it is important to consider the announced policy changes to ban misinformation about the safety, efficacy, or ingredients of currently licensed and administered vaccines on Facebook,Instagram, Twitter, and YouTube. Therefore, measured on a population level, vaccination readiness can serve as an indicator that allows for identifying target groups and providing diagnostic support regarding interventions that could be helpful. Hence, understanding the vaccination readiness and the associated factors of the Covid-19 vaccine would provide valuable insight and guidance for clinical implementation and policy development.

To improve population vaccination readiness, especially among the highlighted groups with low or no vaccination preparedness, and to contain the spread of SARS-CoV-2, the following points should be considered: Concerning the risk perception, protective behavior and acceptance of measures all known associations between the currently prevalent variant, the expected number of cases and the number of severe cases should be communicated transparently and in understandable language. Furthermore, they should identify existing uncertainties. Specific tips for minimizing risks can help here. These should be disseminated via radio, TV and social media. In terms of the knowledge about SARS-CoV-2 and its variants, the acceptance of measures and the vaccination readiness should be clearly explained. It should be also explain why booster vaccination with currently available vaccines is important. In general, access to vaccination should continue to be expanded and barriers reduced, education about vaccination and vaccines should continue, and overall attention should be paid to respectful and factual communication, especially by public figures. In addition, compulsory vaccination is currently being discussed to close the existing vaccination gap. This might be necessary to get people vaccinated who cannot be convinced to vaccinate by existing measures and scientific education.

# References