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Forschungsbericht:

**Impact of Trust in Healthcare Professionals and Agencies on COVID-19 Vaccine Acceptance in Germany**

vorgelegt von

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# **Summary**

The article presented here was prepared in the form of a original research manuscript, which follows the manuscript formatting guidelines in the journal *Frontiers of Public Health*.

Supplementary material can be found in the appendix. The educational questionnaire, (see Appendix A), the questionnaire (see Appendix B) and a listing of places and platforms where the questionnaire was shared (see Appendix C). In addition, a case number calculation was done to estimate the number of cases needed (see Appendix D) and a directed acyclic grah (DAG) was created prior to data collection based on current literature (see Appendix E) to identify possible confounders.

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**Impact of Trust in Healthcare Professionals and Agencies on COVID-19 Vaccine Acceptance in Germany**

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**Keywords: COVID-19, SARS-CoV-2, Vaccine acceptance, Trust, HCPs**

# **Abstract**

**Introduction:** High acceptance of COVID-19 vaccines is instrumental to ending the pandemic(1, 2). This study aims to determine whether trust in healthcare professionals (HCPs) and agencies has an impact on vaccine uptake of the German public during the pandemic as well as to provide evidence that could possibly be used to ultimately remove obstacles preventing high vaccination coverage.

**Methods:** This study based on a cross-sectional online survey between August 1 and November 1, 2021 in Germany. Participants' demographic information, vaccination status and attitudes toward HCPs and institutions were focus analysed in this study. Descriptive analysis and logistic regression were used to detect the association of people`s attitudes toward HCPs and agencies (including government departments) with acceptance of COVID-19 vaccines.

**Results:** Among 828 respondents, 85.7% of them (710/828) received at least 1 vaccination. Vaccine acceptance was slightly influenced by age (OR: 0.97). High evaluation of doctors was associated with higher vaccine acceptance (OR: 2.53, CI: 1.11, 5.82). The lack of explanation of vaccine information was associated with less acceptance (OR: 0.22, CI: 0.12, 0.37). High levels of satisfaction with government and official institutions were also associated with high levels of vaccine acceptance (OR: 1.08, CI:1.06, 1.09).

**Discussion:** High evaluation of doctor's treatment and detailed information on vaccines from the doctor were associated with high COVID-19 vaccine acceptance. High levels of satisfaction and trust in national and official institutions (including government) may be a particularly important factor in influencing people's willingness to be vaccinated. Vaccine acceptance may decline with increasing age. The number of male participants in this study was less than 1∕3 of the total number of participants, the difference between the number of male and female participants was too large to draw conclusions about the effect of gender on vaccine uptake. there was no association between high school diploma and previous vaccination history and covid-19 vaccine uptake. There was no significant evidence to suggest that socioeconomic factors influenced vaccine uptake in this study.

# **Introduction**

The current 2019 coronavirus pandemic (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) threatens and affects lives worldwide(3). In the context of the SARS-CoV-2 pandemic, vaccination is being discussed as essential in the effort to contain the incidence of infection (4). The status as of 09/28/2021 shows that nationwide 64% of the German population are fully vaccinated (5). To achieve an effective coverage of vaccination in Germany, at least 85% of the population aged 12 to 59 as well as 90% of the population aged 60 and older must be fully vaccinated against COVID-19 (6). Hence, there has been a growing interest in research surrounding the vaccination readiness in the population in connection with the SARS-CoV-2 pandemic. Currently, there is very little research on eradication strategies for acute infectious diseases which rely heavily on high vaccination levels for control, such as measles and COVID-19, and even less research on which factors can influence vaccination willingness in the general public (7-9). However, due to the recency of the topic, eg., vaccine readiness in the SARS-CoV-2 pandemic, only a limited number of studies refer to SARS-CoV-2 and the effects linked to the public’s commitment to vaccination (10, 11). Subsequently, it can be considered that factors influencing vaccination readiness may be transferable from other infectious diseases to SARS-CoV-2.

From existing literature, an individual’s perception, disease knowledge, and previous behavior appear to influence their participation in vaccination programs (12-14). Perceived susceptibility for a disease has been found to strongly influence participation in vaccinations (13, 15-18).

It has often been reported that the probability of declining a vaccination offer is increased if a person sees higher risk than reward in receiving the vaccination (19). When the perceived risk from the disease is low, the likelihood of participating in a vaccination program is lower (20). Furthermore, the commitment decreases when a great fear of unwanted side effects is present (21-23), and in general, higher anxiety levels are also associated with low vaccination frequency in the population (24). Additional barriers which limit the success of vaccination programs include the absence of professional vaccination recommendations (25), a lack of adequate transport options to vaccination clinics, and the financial burden it places on older people (26, 27).

Trust in the government and healthcare services significantly impact vaccination participation; more trust in the national government typically leads to a greater population vaccination willingness when compared to countries with less trust (28). The 5C model describes five key psychological reasons for vaccination participation (29). Four of the five C's from the 5C Model (confidence, complacency, constraints, and collective responsibility) appear to display an impact on vaccination participation (25), which will therefore require consideration when attempting to assess and optimize vaccination readiness. Only one of the five C’s (calculation) showed no impact on vaccination participation in previous studies (29). Overall, the attitude towards vaccination is probably the strongest predictor for the intention to vaccinate (30).

There is conflicting evidence regarding the impact of sociodemographic factors on vaccine readiness. In terms of gender, studies have shown that women could be more likely to get vaccinated than men of the same age (9). However, other studies have shown exactly the opposite and report that there is no clear link between gender and vaccination (31-33).

In terms of age, there is no definitive evidence showing which age group is more likely to get vaccinated (16, 31, 34-36). A study by Bock et al. shows that people who regularly get an influenza vaccination are one average three years older than the control group (8). Thus, it appears that age may influence vaccination participation for SARS-CoV-2 to some extent, though more information is needed to quantify this.

There are also several studies which deal with sociodemographic factors in which the results diverge strongly. Educational attainment, as with gender and age, appears to display conflicting evidence from literature as to its impact on vaccine readiness. Some studies show that people with high levels of education are more likely to be interested in vaccinations than people with low levels of education (17, 37). This contrasts a study from Myers et al., which showed the opposite (35).

Literature regarding previous illnesses appears to show discordant findings about an individual’s willingness to get vaccinated. Studies have shown that people with less diseases are more willing to get vaccinated than people who are in bad health conditions (17, 37). In contrary, other studies revealed that people who are willing to get vaccinated suffer more from chronic diseases than healthy people (8). Furthermore, it could be considered that people with unhealthy personal lifestyle choices (e.g., smoking, drugs etc.) show a lower willingness to get vaccinated (17, 37).

Knowledge about immunization is assumed to have both a positive and negative influence on an individual’s perception and attitude towards vaccination. A key factor which affects knowledge of immunization is how health information is researched. The modality of research appears to depend on the socioeconomic position of a person in addition to other personal characteristics, such as age and gender (38, 39).

The internet and social media play an increasingly important role in the dissemination of information about vaccinations and therefore could serve as a tool for spreading information about the vaccination (40) and thus have a presumed influence on vaccine acceptance or refusal (17, 41-43).

Furthermore, healthcare professionals (HCPs) are also thought to influence vaccination willingness (17, 41-43). Maurer et al. (44) and Schwarzinger et al. (31) describe that individuals who received information from a HCP were more likely to get vaccinated and in addition, vaccination willingness increased as a result of HCP recommendations.

It is often assumed that knowledge about herd immunity increases the likelihood of getting vaccinated (45). Similarly, a lack of information about herd immunity and vaccination could be one of the main reasons for low vaccination adherence (46). Overall, it can be assumed that there is a relationship between information-seeking behaviors as well as vaccination knowledge and vaccination willingness or refusal (46, 47).

Due to the recency of the SARS-CoV-2 pandemic, a very limited number of studies have covered factors that influence vaccination willingness or refusal during the SARS-CoV-2 pandemic (10, 11, 48). The initial results of nationwide COVID-19 vaccination readiness studies showed that the most relevant factors were the influence on confidence in the safety of vaccination and perception of personal and social benefits (10, 11, 48). These may be influenced by socioeconomic status and sociodemographic factors. For example, individuals with a low socioeconomic status have a lower tendency to get vaccinated. Furthermore, it was demonstrated that the media can influence the opinion of unvaccinated individuals in particular by creating uncertainty (10, 11, 48).

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 (4). Moreover, it seems likely that detecting factors connected to vaccination willingness would be a distinct advantage for future health communication. On that account, this paper reports the results obtained from the 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 study was designed to evaluate factors associated with vaccination readiness and therefore to identify differences in vaccination willingness or refusal.

# **Methods**

## **Study Design and Setting**

This study shared baseline research data with a cross-sectional online survey named COVIM (Which Factors are Associated with a SARS-CoV-2 Vaccination Readiness in Germany?) from the University of Bremen. The COVIM survey was conducted in the German adult population between August 1 and November 1, 2021.

The questionnaire of COVIM survey was estimated to take 15 min to complete, consisted mainly of multiple-choice questions, occasionally supplemented in some places with open text fields in order to provide space for extensive and individual answers. The questionnaire focused on participants' COVID-19 vaccination status and motivation, while also collecting information on participants' trust in and attitudes toward the German healthcare system, immigration background, socio-demographic characteristics (age, gender, education and employment status, income), daily information sources, political attitudes, current mental and physical health status, and general vaccination history (except COVID-19 vaccines).

The questionnaire design was informed by previous studies and a directed cyclic graph (Appendix X) was created to explore potential confounders. The questions were first pre-tested and were revised and finalized based on feedback from pre-testers.

The COVIM 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, Hannover, Hamburg.

## **Study Variables**

The response variable of this study was acceptance of COVID-19 vaccines in German population. At least one vaccination was defined as vaccine acceptance. Due to previous restrictions on vaccine access and vaccines supplyment in Germany, not all responders had received COVID-19 vaccination at the time of this research analysis, and some willing vaccine recipients were still on the waiting list or had not received a vaccination appointment. To access the acceptance of vaccines, the respondents were provided with the following questions: “Have you been vaccinated against SARS-CoV-2?” and “Would you like to be vaccinated against Corona?”, The possible responses were “yes” or “no.” Those who answered “yes” to either of the two questions above were considered to have accepted the COVID-19 vaccine.

Some explanatory variables were collected.

**Sociodemographic characteristics** included age, gender, educational attainment, employment status, monthly income, household size, general vaccination history. Age remained as a continuous variable for the analysis. Educational attainment was grouped into no occupational degree, occupational training, university degree; University degrees include Bachelor, Master, National Examinations, doctorate and above. Employment status was divided into two groups (employed, unemployed). Individual monthly income was grouped into <1.000 €, 1.000-2.000 €, 2.000-4.000 €, >4.000 €. Household size of respondents was divided into live alone and not live alone. Respondents who had received at least one dose of a protective vaccine (e.g., influenza, measles, etc.) were considered to have a past vaccination history. Respondents were also asked whether they were working as a healthcare worker (HCW) or not.

**The level of trust in HCPs** was assessed by the following three indicators: evaluation of the quality of doctor´s treantment (very high, rather high, rather low, very low), detailed explanation from doctor about the COVID-19 vaccines (yes, no), satisfaction with the doctor´s explanation about vaccines (very high, rather high, rather low, very low).

**Satisfaction level with the national and offical agencies**: Participants were asked how satisfied they were with the work of seven following German state or official agencies in the pandemic: Federal Government, Federal Minister of Health (Jens Spahn), State Government, Health Department, Paul-Ehrlich-Institut, Robert-koch-Institut, German Vaccine Commission (STIKO). Agencies would not analysed as categorical variables, but instead, participants' satisfaction ratings with the agencies were converted into scores. The correspondence between scores and ratings is: very satisfied-50 points, rather satisfied-25 points, can't say anything about this-0 point, rather dissatisfied- -25 points, very dissatisfied- -50 points. The mean score of each participant for the 7 agencies would be considered as the satisfaction level with the national and offical agencies.

## **Statistical Analysis**

Descriptive statistics were reported on socio-demographic characteristcs, reasons to get vaccinated, trust and attitudes towards HCPs, satisfaction scores of national and official agencies. P-values based on t-test for continuous variables and fisher-test for categorical variables were provided to detect differences between COVID-19 vaccination status groups (i.e., acceptance and rejection).

A logistic regression model was employed to examine the association of participants’ attitude towards HCPs and satisfaction of national and official agencies with acceptance of COVID-19 vaccines.

首先通过Univariate logistic regression进行变量探索，p值小于0.，05的变量被选中进行多元分析。多变量模型可以同时处理大量协变量以及混杂因素 ，因此多元逻辑回归模型用来探索（Full Model）。之后进行模型选择，基于AIC的逐步逻辑回归（stepwise）被用来进行调整多元逻辑回归（adjusted logistic regression）

In the first step, associations between explanatory variables and response acceptance were analyzed separately. In the second step, all variables with p ≤ 0.25 in the first step were included in the adjusted analysis. The significance of crude odds ratio (OR) from univariate analyses and adjusted OR (aOR) in multivariate analyses were assessed at α = 0.05. All analyses were performed using R software.

## **Ethical Approval**

The COVIM survey 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**

## **Descriptive statistics results**

### **Disposition and vaccination status**

We received 1,131 responses during the COVIM survey period; 303 of them were excluded due to incomplete data (i.e., finishing less than half of the survey). The final sample size of the current study was 828. 823

Diagram

Description automatically generated

**Flow chart**

1:

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### **Sociodemographic Characteristics**

The majority of participants were young (Appendix X), with a smaller sample of older people, and the average age of the vaccine acceptance group (mean=28.71) was 6 years younger than the refusal group (mean=34.35). 85.7% of the participants (710/828) received at least 1 dose vaccination and 71.5% were females (Appendix X). Over 90% of them have a high school diploma. According to ISCED 2011 standards 50% of the participants have received high education. Around 1∕3 participants worked in health-related industries and 1∕5 of them live alone. Only a small proportion have no vaccination history and the vast majority have received at least one dose of protective vaccine. For national and official agencies satisfaction, the accepting group scored significantly higher than the rejecting group (Appendix X).

3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Demographic variables** | **A** | | **R** | |  |
|  |  |  |  |
| **A (in years)** |  |  |  |  |  |
| N | 732 | | 91 | |  |
| Mean (SD) | 28.7 (10.8) | | 35.7 (14.8) | |  |
| Median | 25 | | 30 | |  |
| , Q3 | , 30 | | 24, 45 | |  |
| Min, | 18, | | 18, | |  |
| **1** |  |  |  |  | 0.117 |
|  | 528 | 92 | 64 | 108 |  |
|  | 197 | 95 | 23 | 05 |  |
|  |  |  |  |  | <0.05 |
|  | 678 |  | 71 |  |  |
|  | 51 |  | 19 |  |  |
|  |  |  |  |  |  |
|  | 218 |  | 10 |  |  |
|  | 125 |  | 34 |  |  |
|  | 371 |  | 43 |  |  |
| O | 18 |  | 4 |  |  |
|  |  |  |  |  |  |
|  | 675 |  | 86 |  |  |
|  | 57 |  | 5 |  |  |
|  |  |  |  |  |  |
|  | 210 |  | 25 |  |  |
|  | 522 |  | 66 |  |  |
| **in** |  |  |  |  |  |
|  | 378 |  | 27 |  |  |
|  | 176 |  | 29 |  |  |
|  | 127 |  | 20 |  |  |
|  | 26 |  | 0 |  |  |
|  |  |  |  |  |  |
|  | 147 |  | 20 |  |  |
|  | 573 |  | 65 |  |  |
|  |  |  |  |  |  |
|  | 636 |  | 71 |  |  |
|  | 95 |  | 20 |  |  |

1. Lala啦啦啦

### **Trust in HCPs and trust ..**

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| --- | --- | --- | --- | --- | --- |
|  | **A** | | **Rejection** | |  |
|  |  |  |  |  |
|  |  |  |  |  |  |
|  | 270 |  | 21 |  |  |
|  | 388 |  | 37 |  |  |
| /Very | 65 |  | 30 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  | 507 |  | 25 |  |  |
|  | 221 |  | 62 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  | 200 |  | 6 |  |  |
| /Very | 29 |  | 13 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| N | 732 | | 91 | |  |
| Mean (SD) | 7.6 (16.9) | | -27.1 (20.0) | |  |
| Median | 7.1 | | -32.1 | |  |
| Q1, Q3 | -3.6, 19.6 | | -42.9, -14.3 | |  |
| Min, Max | -50, 50 | | -50, 25 | |  |

Chart, waterfall chart

Description automatically generated

Chart, bar chart

Description automatically generated

Figure

## **Acceptance of COVID-19 Vaccine and Associated Variables**

Vaccine acceptance decreased by 0.97 times for each additional year of age(OR: 0.97). Vaccine acceptance may decline with increasing age. However, the confidence interval is in fact too narrow, i.e., slightly below 1 (CI: 0.95, 1.00), therefore age cannot be said to be a risk factor, but only slightly affects the vaccine acceptance. People who have a very high evaluation of their doctor's treatment are more likely to accept the vaccine (OR: 2.53, CI: 1.11, 5.82). The results show that the lack of explanation of vaccine information leads to a decrease in vaccine acceptance (OR: 0.22, CI: 0.12, 0.37). A doctor explaining detailed information about the vaccine to people may be a boost to vaccination. People who are highly satisfied with the government or official institutions are more likely to be vaccinated (OR: 1.08, CI:1.06, 1.09).nPositive attitudes and high levels of trust in official agencies are associated with higher acceptance.

Table XX: Univariable logistic regression

|  |  |  |  |
| --- | --- | --- | --- |
| **Predictors** | **Odds Ratios** | **CI** | **p-value** |
| **Age (in years)** | 0.96 | 0.95 – 0.98 | **<0.001** |
| **Gender** |  |  |  |
| Male | 1.00 | Reference |  |
| Female | 0.96 | 0.57 – 1.57 | 0.884 |
| **High school diploma** |  |  |  |
| No | 1.00 | Reference |  |
| Yes | 3.56 | 1.95 – 6.27 | **<0.001** |
| **Educational attainment** |  |  |  |
| No occupational degree | 1.00 | Reference |  |
| Occupational training | 0.17 | 0.08 – 0.34 | **<0.001** |
| University degree | 0.40 | 0.18 – 0.77 | **0.010** |
| Others | 0.23 | 0.05 – 1.62 | 0.079 |
| **Employment status** |  |  |  |
| No | 1.00 | Reference |  |
| Yes | 1.45 | 0.62 – 4.25 | 0.437 |
| **Healthcare related job** |  |  |  |
| No | 1.00 | Reference |  |
| Yes | 1.06 | 0.66 – 1.76 | 0.809 |
| **Monthly income (in €)** |  |  |  |
| <1.000 | 1.00 | Reference |  |
| 1.000-2.000 | 0.43 | 0.25 – 0.75 | **0.003** |
| 2.000-4.000 | 0.45 | 0.25 – 0.85 | **0.011** |
| >4.000 | 0.19 | 0.08 – 0.44 | **<0.001** |
| **Household size** |  |  |  |
| Live alone | 1.00 | Reference |  |
| Not live alone | 1.20 | 0.69 – 2.01 | 0.504 |
| **Vaccination history** |  |  |  |
| No | 1.00 | Reference |  |
| Yes | 1.89 | 1.07 – 3.19 | **0.022** |
| **Evaluation of the quality of doctor´s treatments** |  |  |  |
| Very/rather low | 1.00 | Reference |  |
| Rather high | 4.84 | 2.79 – 8.38 | **<0.001** |
| Very high | 5.93 | 3.21 – 11.16 | **<0.001** |
| **detailed explanation from doctor about Corona vaccine** |  |  |  |
| No | 1.00 | Reference |  |
| Yes | 5.69 | 3.53 – 9.44 | **<0.001** |
| **Satisfaction with the doctor explanation about vaccine** |  |  |  |
| Very/rather low | 1.00 | Reference |  |
| Rather high | 14.94 | 5.47 – 45.47 | **<0.001** |
| Very high | 24.83 | 8.71 – 82.07 | **<0.001** |
| **Satisfaction scores of national and official agencies** | 1.10 | 1.08 – 1.12 | **<0.001** |

Table XX: Multivariable logistic regression

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Predictors** | **Full Model** | | | **Adjusted Model** | | |
| **Odds Ratios** | **CI** | **p-value** | **Odds Ratios** | **CI** | **p-value** |
| **Age (in years)** | 0.98 | 0.95 – 1.01 | 0.128 | 0.97 | 0.94 – 1.00 | 0.054 |
| **High school diploma** |  |  |  |  |  |  |
| No | 1.00 | Reference |  |  |  |  |
| Yes | 0.77 | 0.24 – 2.40 | 0.659 |  |  |  |
| **Educational attainment** |  |  |  |  |  |  |
| No occupational degree | 1.00 | Reference |  | 1.00 | Reference |  |
| Occupational training | 0.33 | 0.10 – 1.01 | 0.056 | 0.26 | 0.08 – 0.75 | **0.016** |
| University degree | 0.68 | 0.23 – 1.86 | 0.465 | 0.59 | 0.21 – 1.56 | 0.309 |
| Others | 2.60 | 0.23 – 58.86 | 0.487 | 2.46 | 0.21 – 54.52 | 0.519 |
| **Monthly income (in €)** |  |  |  |  |  |  |
| <1.000 | 1.00 | Reference |  |  |  |  |
| 1.000-2.000 | 0.42 | 0.17 – 0.99 | **0.048** |  |  |  |
| 2.000-4.000 | 0.77 | 0.30 – 2.00 | 0.583 |  |  |  |
| >4.000 | 0.47 | 0.12 – 1.89 | 0.276 |  |  |  |
| **Vaccination history** |  |  |  |  |  |  |
| No | 1.00 | Reference |  |  |  |  |
| Yes | 1.70 | 0.68 – 4.09 | 0.245 |  |  |  |
| **Evaluation of the quality of doctor´s treatments** |  |  |  |  |  |  |
| Very/rather low | 1.00 | Reference |  | 1.00 | Reference |  |
| Rather high | 2.50 | 1.03 – 5.95 | **0.040** | 3.05 | 1.29 – 7.21 | **0.011** |
| Very high | 2.49 | 0.90 – 6.90 | 0.078 | 3.71 | 1.39 – 10.14 | **0.009** |
| **detailed explanation from doctor about Corona vaccine** |  |  |  |  |  |  |
| No | 1.00 | Reference |  | 1.00 | Reference |  |
| Yes | 3.96 | 2.01 – 8.04 | **<0.001** | 3.50 | 1.79 – 7.02 | **<0.001** |
| **Satisfaction scores of national and official agencies** | 1.10 | 1.08 – 1.12 | **<0.001** | 1.09 | 1.08 – 1.12 | **<0.001** |

### **Sensitivity Analysis**

# **Discussion**

In this study, high evaluation of doctor's treatment and detailed information on vaccines from the doctor were associated with high COVID-19 vaccines acceptance. The observed association are consistent with many previous vaccine studies, a high level of trust and compliance in HCPs can play a key role in promoting patients' vaccine decision-making process.

Outreach strategies by general practitioner and specialist are critical to building trust in COVID-19 vaccination. These strategies can include communications sent to patients and time allocated during office visits to discuss COVID-19 vaccination. This is important not only for the current COVID-19 vaccination, but also for booster vaccinations.

However, it is not enough for HCPs to act as vaccination messengers; current research also shows that high levels of satisfaction and trust in various official institutions, including government, may be a particularly important factor in influencing people's willingness to be vaccinated. Federal and local governments and health system leaders should therefore work to develop messaging strategies to effectively combat vaccine hesitancy. In addition, local health care providers, mass media and political leaders play an important role in increasing confidence in COVID-19 vaccination. Local vaccine program directors should consider collaborating with multiple partners to develop strong communication and promotion activities on a range of vaccination messages.

The current study lacked detailed specific information on the socio-demographic and socio-economic characteristics of population. Evidence from previous studies on the effect of age and gender on vaccine uptake is equivocal, and the current study has only slight evidence to suggest that older age groups are more likely to be vaccine hesitant. Because our sample population was young, with an average age of 29 years for the total sample, there was a serious lack of older samples. Although marginally significant results were obtained, they are not sufficient to suggest that there is an association between age and vaccine intention.

The number of male participants in this study was less than one third of the total number of participants, the difference between the number of male and female participants was too large to draw conclusions about the effect of gender on vaccine uptake.

With the exception of the age factor, there was no association between high school diploma and previous vaccine history and COVID-19 vaccine uptake. As most of the actual participants in this study were students, nearly 90% of the respondents had taken the Abitur exam, the sample lacked generalisability, there was a lack of variation in socio-economic characteristics, and half of the respondents reported having a university degree or higher.

These socio-demographic and socio-economic characteristics measured in this study are therefore not really representative of the German population in general, and there is a significant lack of information on the occupational training population and industry. In order to determine the relevant factors, studies with more heterogeneous populations may be needed.

**Bias**

**Limitation**

# **Conclusion**

Acceptance of the COVID-19 vaccine in Indonesia is influenced by the effectiveness of the vaccine. Acceptance is relatively high when the vaccine has a very high effectiveness, but it reduced to only 67.0% when the vaccine efficacy is 50%. If the COVID-19 vaccine has lower efficacy, governments will have to introduce more strategies to persuade their population to become vaccinated. In addition, since acceptance is associated with perceived risk for COVID-19, it is also important to increase the perceived risk in communities.

# **Conflict of Interest**

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# **Appendix**

Appendix X:

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Appendix X:

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Appendix X:

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Appendix X:

Figure 1 | COVID-19 vaccine intention by age

图表, 直方图

描述已自动生成

Figure 2 | COVID-19 vaccine intention by satisfaction scores of national and official agencies

图表, 直方图

描述已自动生成