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RESEARCH ARTICLE

Big Five Personality Traits and Willingness to Get Vaccinated Against COVID-19: Findings from a German-Speaking Sample

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COVID-19 vaccinations are an effective countermeasure for the pandemic if a high proportion of the population is vaccinated (Lau, 2021). To reach those who do not want to be vaccinated, the investigation of their characteristics is of high importance. In the present study (*N* = 467), we examined COVID-19 vaccine accepting and hesitant individuals for possible differences in their Big Five personality traits and sub-facets. Vaccine accepting individuals were more agreeable than hesitant individuals. Furthermore, accepting individuals showed higher levels of altruism (a sub-facet of agreeableness) and lower levels of depression (a sub-facet of neuroticism) than hesitant individuals. No other differences were observed. Our study and previous literature suggest that personality does not impact, or only weakly impacts, the willingness to get vaccinated against COVID-19. We discuss other factors that might determine vaccine hesitancy.

Keywords: COVID-19 vaccines, vaccine hesitancy, personality, Big Five

Just two months after officially declaring the outbreak of the COVID-19 pandemic (World Health Organization [WHO], March 2020), the WHO outlined the extensive immunization against COVID-19 as a global public good to prevent, contain, and stop the transmission of the virus (WHO, May 2020). However, even prior to the availability of COVID-19 vaccines, about 26% of European adults were unsure about whether they would get vaccinated or already declined to do so (Neumann-Böhme et al., 2020). This COVID-19 vaccine hesitancy – defined as "delay in acceptance or refusal of vaccination despite availability of vaccination services" (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015) – poses a major threat for humans as it could jeopardize the goal of herd immunity.

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To increase vaccination willingness, governments launched initiatives to advertise the COVID-19 vaccine (for the Austrian initiative see www.oesterreich-impft.at). Psychological research could inform such initiatives by providing knowledge on factors influencing vaccination willingness. Therefore, in the present study, we investigated personality as a potential determinant for the willingness to get vaccinated against COVID-19. More specifically, we aimed at testing possible differences in the Big Five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness) and their respective sub-facets (see Table 1) of COVID-19 vaccine accepting and hesitant individuals.

The Big Five traits are a popular and extensively researched taxonomy for describing individuals' personality (Rammstedt & Danner, 2016). The trait extraversion – as measured by the Big Five Inventory by Rammstedt and Danner (2016) – is characterized by being full of energy (sub-facet activity) and having a determined, vigorous, and sociable personality (sub-facet assertiveness). Agreeableness encompasses qualities such as empathy and selfless solidarity (sub-

facet altruism) coupled with peacefulness and courtesy (sub-facet compliance). The trait conscientiousness is characterized by individuals being reliable and persevering (sub-facet self-discipline) as well as orderly (sub-facet order). Neurotic people tend to be insecure and anxious (sub-facet anxiety) while also being characterized by emotional instability and dejection (sub-facet depression). Finally, openness to experience means having wide interests and being open to new ways of thinking (sub-facet ideas) as well as having a pronounced sense of aesthetics and art (sub-facet aesthetics).

Table 1

Big Five personality traits and sub-facets measured with the Big Five Inventory (Rammstedt & Danner, 2016)

Big Five traits	Sub-facets
Extraversion	Assertiveness & Activity
Agreeableness	Altruism & Compliance
Conscientiousness	Order & Self-Discipline
Neuroticism	Anxiety & Depression
Openness to Experience	Aesthetics & Ideas

Big Five and Health Behavior

In previous studies, two of the Big Five traits – conscientiousness and agreeableness – showed rather consistent positive associations with health-promoting behaviors and negative associations with health-risking behaviors. For instance, higher levels in these traits are accompanied by less traffic and substance-related risk-taking behavior (Booth-Kewley & Vickers, 1994; Hampson et al., 2007). Furthermore, individuals with high conscientiousness and agreeableness are more likely to receive influenza vaccinations (Pandhi et al., 2016) and have more positive attitudes towards vaccinations in general (Lee et al., 2017; Lin & Wang, 2020). Individuals high in conscientiousness and/or agreeableness might, thus, follow social norms, avoid violating precautionary rules, and might be more willing to actively take care of their health.

In contrast, for the other Big Five traits – neuroticism, openness, and extraversion – the results are rather inconclusive and thus no clear pattern about their link to health behavior can be observed. Neuroticism seems to predispose various unhealthy behaviors such as eating unhealthily (Booth-Kewley & Vickers, 1994; Sirois & Hirsch, 2015). However, because neurotic individuals are also concerned about their health (Van Dijk et al., 2016), they show increased healthcare utilization (for a review see Hajek et al., 2020). Additionally, neuroticism is positively related to getting vaccinated against influenza (Brewer & Hallman, 2006; Nolan et al., 2019) and to positive attitudes towards vaccinations in general (Lin & Wang, 2020; but see Demir et al., 2020 for null effects).

Similar to neuroticism, mixed effects are observed for openness and extraversion regarding general health behaviors (e.g., Iwasa & Yoshida, 2020, for positive effects of both; Zvolensky et al., 2015, for negative effects of openness; Otonari et al., 2012, for negative effects of extraversion). Regarding vaccinations, individuals with high openness are found to be more likely to get vaccinated against influenza (Pandhi et al., 2016). In other studies, however, openness predicts adverse vaccination attitudes (Browne et al., 2015; Lee et al., 2017). For extraversion, most studies do not observe a connection between extraversion and vaccination attitudes (Lin & Wang, 2020).

Big Five and COVID-19

While many studies have investigated links between personality and health behaviors beyond the ongoing pandemic, few have investigated how the Big Five traits are associated with specific COVID-19 preventive measures. However, findings to date indicate that conscientiousness and agreeableness are positively associated with adherence to preventive measures such as wearing masks, handwashing, or social distancing (Blagov, 2021; Krupić et al., 2021;). Furthermore, neuroticism and openness are related to COVID-19 preventive measures (Airaksinen et al., 2021; Welter et al., 2021). For extraversion, most studies show negative associations (Chan et al., 2021; Nofal et al., 2020), suggesting that extraverts might have problems with certain preventive measures such as social distancing.

Due to these associations, it could be argued that personality contributes to one of the most important COVID-19 preventive measures – the willingness to get vaccinated against COVID-19. Indeed, first studies on this behalf support this assumption. In a study by Murphy et al. (2021), individuals from the UK and Ireland were asked whether they would get vaccinated with a mRNA/viral vector COVID-19 vaccine when it becomes available. In the UK sample, accepting individuals (i.e., individuals that are willing to get vaccinated) were found to be more conscientious, agreeable, and extroverted but less neurotic than hesitant individuals. In the smaller sample from Ireland, however, there was only one

significant difference: accepting individuals showed higher levels of agreeableness than the hesitant group (see also Yanto et al., 2021). For openness, there were no significant group differences in either of the two samples.

Studies on the correlational relationship between personality and the willingness to get vaccinated against COVID-19 yield rather mixed findings. Conscientiousness, agreeableness, and openness showed positive links in some studies but virtually no associations in others (Gonçalves et al., 2022; Graeber et al., 2021; Mo et al., 2021). For instance, Li (2022) observed a positive relationship between conscientiousness and the willingness to get vaccinated against COVID-19, whereas other studies observed no significant correlation between these factors (Gonçalves et al., 2022; Graeber et al., 2021). For neuroticism, studies suggest no significant relationship with the willingness to get vaccinated against COVID-19 (Gonçalves et al., 2022, Howard, 2022). Although also obtaining mixed findings for extraversion (cf. Gonçalves et al., 2022; Hyland et al., 2021), the majority of studies suggest that extraversion may not be a relevant factor for COVID-19 vaccination readiness (Gerretsen et al., 2021; Salerno et al., 2021).

From these studies, it remains rather unclear if and in what direction the Big Five traits are related to COVID-19 vaccination willingness. The results might differ due to varying sample sizes (e.g., different results in a larger and smaller sample in Murphy et al., 2021) and different locations of data collection (e.g., Central Europa, US, Asia).

Present Study

Most of the studies described in the previous section were conducted before a COVID-19 vaccine was fully developed (i.e., during the year 2020). Thus, they were hypothetical in nature (see Graeber et al., 2021; Mo et al., 2021;) and presupposed vaccination efficacy (see Murphy et al., 2021) or the absence of side effects (see Graeber et al., 2021). The present study, in contrast, was conducted in April and May 2021 when already some well-known, publicly discussed vaccines were on the market and a first batch of people was already vaccinated. More specifically, approximately 21% of the Austrian population (where the study was conducted primarily) had received the first doses of the COVID-19 vaccine at the beginning and around 28% at the end of data collection period (Ministry for Social Affairs, Health, Care and Consumer Protection, 2021b).[3] Due to the strict eligibility criteria at this time (see footnote 3), many participants of our sample might not have had the opportunity get vaccinated yet.[4] However, our study was conducted at a stage when the question of whether one would get vaccinated once given the opportunity was acute. Furthermore, side effects of the vaccines were publicly discussed at this time, which are probably an important component in vaccination-related decision-making. Hence, the present study is an essential addition to previous studies by investigating personality differences in the willingness to get vaccinated against COVID-19 in spring 2021.

In the present study, we asked participants whether they already got vaccinated against COVID-19 (yes/no) and if not, whether they will get vaccinated once they have the opportunity to do so (yes/no/maybe). Based on the definition of MacDonald and the SAGE Working Group on Vaccine Hesitancy (2015), individuals that are delaying the decision whether to get vaccinated or not (i.e., indicating "maybe" in our study) and individuals that refuse to get vaccinated can be combined into one group. Thus, we exploratorily investigated personality differences between individuals that already got vaccinated or are willing to get vaccinated (vaccine accepting group) and individuals that are delaying the decision to get vaccinated or refuse to get vaccinated against COVID-19 (hesitant group).[5] As previous findings on the intersection between personality traits and COVID-19 vaccination willingness have been relatively inconsistent, we did not derive specific hypotheses for our study.

With this study, we aimed at a better understanding of characteristics that differentiate vaccine accepting and hesitant individuals. Knowledge on the characteristics of COVID-19 vaccine hesitant individuals could help governmental initiatives to

[3] At this timepoint, especially individuals living or working in elderly homes, individuals above 65 years old or with pre-existing risk factors, individuals working in the health sector, schools, kindergartens, or social professions were able to receive the COVID-19 vaccine (see phases 2 and 3 of the Austrian vaccination schedule; Ministry for Social Affairs, Health, Care and Consumer Protection, 2021a). Starting with June 2021, all adults living in Austria were eligible to get vaccinated.

[4] We did not collect data on whether the participants actually were eligible for the COVID-19 vaccine or not. But, as our sample was rather young and the eligibility criteria were rather strict, we believe that many participants could not get vaccinated due to the governmental rules yet.

[5] We additionally report the comparison of the three separate groups (accepting, delaying, and refusing) in the supplementary material (see table S5 and S6 here https://osf.io/5u3a7/).

directly address these individuals and potentially alleviate their concerns. For a differentiated picture of possible personality differences, we tested not only the Big Five factors but also the corresponding sub-facets (see Table 1). To our best knowledge, no previous study investigated differences in the Big Five sub-facets between COVID-19 vaccine accepting and hesitant individuals. Thus, it is so far unclear whether vaccine hesitant individuals differ on potentially relevant facets such as altruism or anxiety. An investigation of Big Five sub-facets is also important because previous literature showed that specific sub-facets are able to explain certain behaviors above and beyond the global Big Five traits (Rammstedt & Danner, 2016). Including both Big Five traits and their respective sub-facets might, thus, help to gain a deeper understanding of personality differences between COVID-19 vaccine accepting and hesitant individuals. Furthermore, we aim to complement previous studies with data from a German-speaking sample – a population that has so far been underrepresented in research on COVID-19 vaccination willingness.

Methods

Participants

The total sample consisted of 467 participants (290 females – 62.10%, 176 males – 37.69%, and 1 diverse – 0.21%) and the mean age of the participants was 31.32 years (SD = 14.89 years; range = 18-77). The majority had either a German (e.g., *Abitur*) or Austrian (e.g., *Matura*) university entrance qualification (259 participants – 55.46%) or a university degree (113 participants – 24.20%). In contrast, only 65 had an apprenticeship or vocational school diploma (13.92%), 18 had a secondary school diploma (3.85%), 11 had a compulsory or lower secondary school diploma (2.36%) and 1 person had no school diploma (0.21%). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. All participants gave their informed consent prior to participating in the study.

Procedure

The participants were recruited by students participating in an undergraduate psychology class at an Austrian university. They sent standardized invitations with a link to the online study to potential participants. The participants were required to be at least 18 years old and to speak German as their mother tongue or to have equivalent German language skills. In this large online survey – conducted between April 20th to May 5th, 2021 – several topics were investigated (for on overview of the full procedure and used materials see https://osf.io/5u3a7/). At the beginning of the survey, the participants received information about the confidentiality of their data, the voluntary nature of participation, and the inclusion criteria (i.e., minimum age and German language proficiency). Subsequently, the participants read and approved the informed consent and the data protection declaration. Then, sociodemographic data were collected, including age, gender, and level of education. Following this, several questionnaires were presented, but in this article, we only describe the materials that are relevant for the present research question. These materials included the Big Five Inventory (Rammstedt & Danner, 2016), and questions related to the willingness to get vaccinated against COVID-19. The participation in the whole survey took approximately 20 minutes.

Materials

Big Five Inventory. The Big Five personality traits were measured with the Big Five Inventory (BFI) in the German adaption by Rammstedt and Danner (2016). The BFI contains 45 items using a five-point Likert scale ranging from "*Strongly disagree*" to "*Strongly agree*". Each of the five personality traits was measured by eight to ten items from which a mean score for each trait can be derived. Higher mean scores indicate higher levels on the corresponding trait. The internal consistencies of the five traits were good or even excellent: conscientiousness (Cronbach's α = .86), agreeableness (Cronbach's α = .78), neuroticism (Cronbach's α = .81), openness (Cronbach's α = .82), and extraversion (Cronbach's α = .88). Moreover, two sub-facets per Big Five trait can be derived (see Table 1). Due to the smaller number of questions per sub-facet, lower internal consistencies are to be expected (Rammstedt & Danner, 2016). For three of the sub-facets the internal consistency was indeed rather low: altruism (Cronbach's α = .59), compliance (Cronbach's α = .54) and depression (Cronbach's α = .56). The internal consistency of the other sub-facet scales reached acceptable to excellent levels: assertiveness (Cronbach's α = .84), activity (Cronbach's α = .63), order (Cronbach's α = .62), self-discipline (Cronbach's α = .77), anxiety (Cronbach's α = .73), openness for aesthetics (Cronbach's α = .82) and openness for ideas (Cronbach's α = .61).

COVID-19 Vaccination Willingness. To investigate participants' willingness to get vaccinated against COVID-19, we asked them the following question(s) in German (here translated to English for illustration):

Table 2
Comparison of the accepting and hesitant group on the Big Five traits.

	accepting		hesitant				
	n = 340		*n* = 127				
	M	*SD*	*M*	*SD*	*t*	*p*	Cohen's *d*
Big Five							
Extraversion	3.58	0.77	3.47	0.84	1.38	.168	0.15
Agreeableness	**3.74**	**0.59**	**3.59**	**0.61**	**2.26**	**.025**	**0.24**
Conscientiousness	3.68	0.73	3.67	0.70	0.05	.959	<0.01
Neuroticism	2.83	0.74	2.86	0.72	-0.43	.665	-0.05
Openness	3.50	0.69	3.53	0.67	-0.54	.592	-0.06

"Are you already vaccinated against COVID-19?"
"Yes" or *"No"*

If "No" was indicated, another question followed:

"Will you get vaccinated against COVID-19 as soon as you have the opportunity?"
"Yes", "No", or *"Maybe"*

This second question was important to assess vaccination willingness in participants that were not eligible to get vaccinated at the time of the study (see footnote 3 for eligibility criteria), but still wanted to get vaccinated as soon as possible. Furthermore, it allowed the participants to be divided into three groups: vaccine accepting, delaying, and refusing. Subjects who stated that they had already been vaccinated or would get vaccinated formed the "accepting" group[6]. Those who stated "maybe" are classified as delaying the decision to get vaccinated against COVID-19. Those who stated that they will not get vaccinated are referred to as refusing individuals. Following the definition of vaccine hesitancy (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015), for our main analyses we combined the delaying and the refusing individuals into a hesitant group. Nevertheless, comparisons of all three groups can be found in the supplementary material (Tables S5 and S6 here https://osf.io/5u3a7/).

Results

We analyzed our data using IBM® SPSS® Statistics, version 27. Most of our participants were in the COVID-19 vaccine accepting group (340 participants – 72.81%), which included 85 participants (18.20%) that were already vaccinated and 255 participants (54.60%) that were willing to get vaccinated as soon as they have the opportunity. The remaining 127 participants (27.19%) which formed the hesitant group were either delaying the decision to get vaccinated (83 participants – 17.77%) or refused to get vaccinated against COVID-19 (44 participants – 9.42%). The common assumptions of statistical tests were met unless otherwise noted.

Big Five traits and COVID-19 vaccination willingness

To test potential differences in the Big Five traits between the accepting and hesitant group, we used Welch *t*-tests (adjusting for unequal sample sizes and variances). The vaccine accepting group (M = 3.74, SD = 0.59) showed significant higher levels of agreeableness than the hesitant group (M = 3.59, SD = 0.61), $t(220.79) = 2.26$, $p = .024$, $d = 0.24$. None of the other *t*-tests reached significance (see Table 2).

[6] We did not expect any differences between participants that were already vaccinated (N = 85) and participants that were willing to get vaccinated as soon as they have the opportunity (N = 255) and thus combined these two groups for our main analyses. This assumption is supported by additional analyses that indeed do not show any differences between these groups in the Big Five traits and sub-facets (see Tables S1 and S2 here https://osf.io/5u3a7/).

Table 3
Comparison between the accepting and hesitant group regarding the Big Five sub-facets.

	accepting		hesitant				
	n = 340		*n* = 127				
	M	*SD*	*M*	*SD*	*t*	*p*	Cohen's *d*
Extraversion							
Assertiveness	3.50	0.85	3.37	0.95	1.33	.186	0.15
Activity	3.74	0.81	3.70	0.81	0.49	.624	0.05
Agreeableness							
Altruism	**3.76**	**0.64**	**3.60**	**0.66**	**2.42**	**.017**	**0.25**
Compliance	3.62	0.74	3.60	0.83	0.17	.868	0.02
Conscientiousness							
Order	3.48	1.04	3.43	1.03	0.45	.657	0.05
Self-Discipline	3.65	0.74	3.62	0.69	0.32	.746	0.03
Neuroticism							
Anxiety	2.98	0.86	2.92	0.87	0.61	.545	0.06
Depression	**2.55**	**0.90**	**2.85**	**0.88**	**-3.23**	**.001**	**-0.33**
Openness							
Aesthetics	3.37	1.10	3.24	1.04	1.20	.231	0.12
Ideas	3.54	0.66	3.66	0.63	-1.78	.077	-0.18

Big Five sub-facets and COVID-19 vaccination willingness

We also compared the two groups in terms of the Big Five sub-facets using Welch *t*-tests. Here, the vaccine accepting group (M = 3.76, SD = 0.64) reached significantly higher levels of altruism than the hesitant group (M = 3.60, SD = 0.66), $t(220.46) = 2.42$, $p = .017$, $d = 0.25$. In addition, the vaccine accepting group (M = 2.55, SD = 0.90) showed significant lower levels of depression than the hesitant group (M = 2.85, SD = 0.88), $t(231.90) = -3.23$, $p = .001$, $d = -0.33$. None of the other *t*-tests reached significance (see Table 3).

Discussion

The COVID-19 vaccine is only an effective countermeasure against the ongoing pandemic when a sufficiently large proportion of the population is getting vaccinated (Lau, 2021). Currently, however, only about 68% of the Austrian population is fully vaccinated (as of beginning of May 2022; Health ministry, 2022). In the present study, we exploratorily tested whether individuals with a different willingness to get vaccinated against COVID-19 show discrepancies in their Big Five personality traits and sub-facets. If characteristics of vaccine hesitant individuals are known, they could be specifically addressed by governmental vaccination initiatives.

Our tested sample of 467 German-speaking individuals included 70% vaccine accepting individuals (340), 20% delaying individuals (83), and 10% refusing individuals (44; the latter two formed the joint group of hesitant individuals for our main analyses). This distribution is similar to a larger German sample tested in the study by Graeber et al. (2021) and samples from the UK and Ireland tested by Murphy et al. (2021). These previous studies tested vaccination willingness already before a vaccine was

fully developed and ready to be vaccinated. Nevertheless, the distribution of vaccine accepting, delaying, and refusing individuals appears similar even after the vaccine was made available – as observed in the present study.

As our main research question, we tested differences between the vaccine accepting and hesitant group with regard to their Big Five traits: conscientiousness, agreeableness, neuroticism, openness, and extraversion. Consistent with findings from previous studies (Lin & Wang, 2020; Nofal et al., 2020), our results show that the COVID-19 vaccine hesitant group had lower levels of agreeableness than the accepting group. This supports the assumption that there is a link between agreeableness and health promoting behaviors (Booth-Kewley & Vickers, 1994; Hampson et al., 2007; Sirois & Hirsch, 2015). Individuals with high agreeableness might be more prone to follow social norms which in return positively affects their health behavior – such as getting vaccinated against COVID-19. In contrast, individuals low in agreeableness might tend to hazardous behaviors which include the confrontation with or the violation of rights of others (Booth-Kewley & Vickers, 1994).

Regarding the other Big Five traits (conscientiousness, neuroticism, openness, and extraversion) we did not observe differences between vaccine accepting and hesitant individuals. Only on some sub-facets were group differences observed: the hesitant group showed lower levels of altruism – a sub-facet of agreeableness – than the accepting group. This finding is consistent with previous studies suggesting that altruistic attitudes are positively related to vaccination willingness (Rieger, 2020; Shim et al., 2012). Especially for young individuals, prosocial tendencies that are part of altruism appear to shape COVID-19 vaccination attitudes (cf., Tanaka et al., 2021). Furthermore, according to Shim et al. (2012) the principle of herd immunity states that above a certain vaccination level within the population, a disease can be eradicated without the need to have every single individual vaccinated. They argue that while those who get vaccinated experience certain costs of vaccination (e.g., time, side effects), the unvaccinated benefit equally from a high vaccination coverage level without experiencing costs. Therefore, the decision to get vaccinated seems to depend ¬– at least to a certain extent – on the willingness of individuals to act altruistically.

Moreover, the hesitant group showed higher levels of depression (a sub-facet of neuroticism) than the accepting group. This is consistent with the findings of Palgi et al. (2021) who showed that COVID-19 vaccine hesitancy is associated with higher levels of depression. In addition, it is well known that depressed individuals often have problems deciding (Maddox et al., 2012; Paulus & Yu, 2012) which might be related to vaccine hesitancy. The results of the Big Five sub-facets should, however, be interpreted with caution as the BFI questionnaire only contains up to five questions per sub-facet and thus that the internal consistency is not sufficient on every facet.[7]

Overall, our results suggest that personality traits seem to play a rather small role, or no role at all, when it comes to COVID-19 vaccination willingness. While we observed group differences regarding agreeableness and its sub-facet altruism as well as the neuroticism sub-facet depression, the groups did not differ with regard to conscientiousness, openness, and extraversion as well as the respective sub-facets. Although conscientiousness was shown to be positively related to attitudes towards vaccinations in general (Lin & Wang, 2020) and COVID-19 preventive measures (Krupić et al., 2021; Blagov, 2021), it does not seem to impact COVID-19 vaccination willingness – at least not in our study. Thus, conscientiousness might foster the adherence to easily implemented measures such as hand-washing or wearing masks, but not impact the decision whether to get vaccinated or not (for similar results see Gonçalves et al., 2022; Graeber et al., 2021). Also, the personality trait openness seems irrelevant for COVID-19 vaccination decisions within our sample. This finding is in line with previous studies that showed inconsistent results with regard to openness and different health behaviors (Iwasa & Yoshida, 2020; Zvolensky et al., 2015). For extraversion, our study supports the negligibility of this trait in relation to health behaviors in general (Gerretsen et al., 2021; Sirois & Hirsch, 2015) and for vaccinations more specifically (Lin & Wang, 2020). Although extraverted individuals might have problems with adhering to COVID-19 preventive measures such as social distancing (Chan et al., 2021; Nofal et al., 2020), they might not be more eager to get vaccinated in order to protect themselves or others.

Similar to the present study, some of the larger studies running in 2020 suggest that personality traits – if at all – only minimally impact COVID-19 vaccination willingness. For instance, Graeber et al.

[7] The same results with regard to the Big Five traits and sub-facets were observed when only comparing participants that are willing to get vaccinated (but did not get vaccinated yet) and the hesitant group. For details, please refer to the supplement (tables S3 and S4, https://osf.io/5u3a7/).

(2021) – who tested about 6700 individuals – showed that vaccination willingness is related to sociodemographic characteristics (e.g., age, gender, education) but not to personality traits. Moreover, it should be noted that if significant effects were observed in previous studies, they were rather small (Mo et al., 2021), and thus can only be detected in very large sample sizes. However, very small effect sizes might not be of a high practical and scientific relevance (see Kirk, 2001, for a discussion on relevant effect sizes).

Limitations

Several limitations of the present study should be discussed. Although we aimed at recruiting a sample with broad sociodemographic characteristics, most of our participants have obtained a high level of education, were female, and rather young. Thus, our sample might have a limited representativeness regarding the German-speaking population. The origin of our population is both a benefit but also a limitation of our study. Our study adds findings from a German-speaking sample to the growing literature on COVID-19 vaccination, that mostly investigated this topic in North American or Asian countries (Murphy et al., 2021; Mo et al., 2021; but for a somewhat similar German sample see Graeber et al., 2021). On the other hand, the interpretation of our results should only be limited to this population, as the willingness to get vaccinated against COVID-19 might vary between countries. In addition, we did not ask the participants for their current residency, thus we cannot be sure about them being Austrian or living in Austria (where the study was primarily conducted). However, as our study needed to be completed in German and the data was collected by Austrian psychology students, we believe that most of our participants were either Austrian or German. Further studies that separate the participants according to their country of origin or residency would be desirable, as this would enable international comparisons on vaccine hesitancy.

In addition, we did not assess whether the participants previously had the opportunity to get vaccinated. Due to the governmental vaccination plan, we believe that only a small proportion of our sample was eligible to get vaccinated at the time of our study. Indeed, individuals that already were vaccinated within our sample were older than individuals that want to get vaccinated but did not have the opportunity yet (see https://osf.io/5u3a7/ for this analysis). This aligns with the vaccination plan in which older individuals, individuals in risk groups, and individuals with specific professions were prioritized. As younger individuals and students did not meet these criteria, we believe that many of our participants were not yet eligible for the COVID-19 vaccination. Nevertheless, as we did not assess participants' eligibility, we cannot make strong claims about this.

Furthermore, it must be noted that participants might have interpreted our central question (i.e., whether they would get vaccinated if they have the opportunity) differently. While such an "opportunity" could be understood as the eligibility to get vaccinated, it could also be understood as, for instance, having time to get the COVID-19 vaccine. However, the second interpretation seems unlikely as – at the time of the study – it was rather difficult to postpone a vaccination appointment which one got automatically when meeting the eligibility criteria. Postponing the allocated vaccination slot would have meant to wait for quite some time to get a new appointment, thus we strongly believe that most individuals who wanted to get vaccinated did so as early as possible.

It must also be considered that our analyses were based on groups with rather large differences in group sizes. To account for this, we used statistical tests that are mostly robust with regard to sample size deviations. Furthermore, such differences occur naturally, as they are similar to vaccination rates in the population (for Austrian rates see Health ministry, 2022). Finally, as the aim of our study was to test the link between typical personality traits and COVID-19 vaccination willingness, we did not assess any additional COVID-19-related variables such as concerns about getting infected with COVID-19 or fears about being vaccinated. However, we strongly urge for further studies that investigate such factors as potential determinants of the willingness to get vaccinated against COVID-19.

Future Directions

Apart from the Big Five traits, other factors such as cognitive abilities and specific beliefs might cause individual differences in COVID-19 vaccination willingness. For instance, Maroiu et al. (2022) observed that higher levels of cognitive reflection abilities increase the odds of getting vaccinated. Also, individuals' perceived efficacy of the COVID-19 vaccination predicts vaccination willingness (Mo et al., 2021) and vaccine hesitant individuals show lower levels of trust in scientists, health care professionals, and the government than vaccine accepting individuals (Murphy et al., 2021). Additionally, a study by Winter et al. (2021) observed that subjective norms (i.e., if one's close others approve vaccinations) as well as conspiracy beliefs are associated to vaccination intentions.

The realization of more original as well as replication studies is necessary to obtain a clearer picture of the determinants of vaccination willingness. This should be done both in the light of the ongoing COVID-19 pandemic but also with regard to general vaccination attitudes. Then, governments can learn from scientific findings regarding the determinants of vaccination willingness in order to increase vaccination rates. For instance, the trustworthy elucidation of conspiracy theories might be a promising strategy to minimize concerns about the COVID-19 vaccine.

Conclusion

To conclude, our exploratory study aimed at testing whether COVID-19 vaccine accepting and hesitant individuals show discrepancies regarding their Big Five personality traits and sub-facets. Hesitant individuals showed a lower agreeableness than accepting individuals. However, overall personality traits appear not very important when it comes to vaccination willingness. Future studies might focus on other factors such as beliefs in conspiracy theories or mistrust in the government that act as determinants of vaccine hesitancy. Presumably, the topic of vaccination has never been so high on the global agenda and the current situation could have an impact on people's thinking about vaccinations in general in the future. Therefore, more clarity and understanding of different positions on vaccination willingness should be reached by using the potential that this global pandemic has for research – besides all the suffering it has brought.

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Contributorship Statement

Amelie Weikl: Conceptualization; Methodology; Data analysis, Writing – original draft.
Stella Kaetzke: Conceptualization; Methodology; Data analysis, Writing – original draft.
Anna Züger: Conceptualization; Methodology; Writing - review & editing.
Sandra Grinschgl: Conceptualization; Methodology; Project administration; Supervision; Writing - review & editing.

Conflicts of Interest

The authors declare no conflicts of interest.

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