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What Drives Belief in Vaccination Conspiracy Theories in Germany?

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In the midst of a pandemic, the efficacy of official measures to mitigate the COVID-19 crisis largely depends on public attitudes towards them, where conspiracy beliefs represent potential threats to the efficacy of measures such as vaccination. Here, we present predictors and outcomes associated with a COVID-19 vaccination conspiracy belief. In a representative survey of Germany, sociodemographic predictors of this belief were found to include age, federal state, migration background and school leaving qualification. The study revealed correlations with trust in scientific and governmental information sources, respondents' self-assessment of being informed about science, general conspiracy mindedness, the frequency of using Twitter and messaging apps, as well as willingness to voluntarily take the COVID-19 vaccine. Our results cohere with and build on the general literature on conspiracy mindedness and related factors. The findings provide an evidence base for more effective health and crisis communication in Germany and beyond.

Keywords: COVID-19, vaccination, conspiracy theories, health communication, crisis communication

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INTRODUCTION

Public attitudes towards science are a matter of life and death in the midst of a public health crisis. Conspiracy thinking, anti-vaccine movements and distrust of expert institutions threaten to prolong the devastating impact of the COVID-19 pandemic by limiting uptake of life-saving vaccines. Here, we investigate a particular vaccine-linked conspiracy belief, namely that “*The coronavirus (COVID-19) is part of a global effort to enforce mandatory vaccination*”, to gain more insight about subsets of the population in Germany that tend to express agreement with it. Following previous literature (e.g., Franks et al., 2013), we understand conspiracy theories as attempts to explain seemingly random events through the work of malicious agents that operate behind the scenes. According to these beliefs, nothing happens by accident; nothing is as it seems; and everything is connected (Burkun, 2013, p. 3–4).

Vaccinations have always been accompanied by conspiracy theories and general public skepticism. Since the middle of the 19th century, fierce debates about vaccines have been held within Germany, including publication of a large number of anti-vaccination books and papers (Meyer and Reiter, 2004). Within this literature could be found the claim that vaccination was part a Jewish conspiracy to damage the German population. Mandatory smallpox vaccinations for children were first introduced in Germany in 1874 with the “Reichsimpfgesetz” (Vaccination Act). In response to this, journals such as “Der Impfgegner” (the vaccination objector) were created by skeptics to advance their opposition. Scepticism and critical attitudes towards vaccinations have occurred in the German population since then, influencing vaccine acceptance up to the present day.

With the first cases being reported in Wuhan (China) in December 2019 (WHO, 2020), the novel SARS-Cov-2 virus quickly spread around the world with the first official case inside Germany being confirmed on January 27th 2020. Following the national pandemic plan, advised by the Robert Koch Institute (RKI), on March 13th the country entered the *protection stage*, closing schools and borders. A first loosening of restrictions occurred in mid-April 2020. Despite a relatively calm summer, the number of cases increased from the end of August, followed by a second national partial lockdown starting on November 2nd, 2020. By the end of November, Germany reached the total number of one million reported infections. In spite of a hard lockdown imposed on December 15th, infection numbers were persistently high and only began declining from mid-January 2021.

Since March 2020, vaccination has been lauded as the key to exiting the pandemic. While in April 2020 79% of the Germany population was willing to get vaccinated, this dropped to 62% as of January 2021 (COSMO - COVID-19 Snapshot Monitory, 2021). In general, many factors influence the willingness to get vaccinated, for example, fear of unforeseen side effects (Neumann-Böhme and Sabat, 2021), past immunisation experiences, expert advice and perceived efficacy (Deshpande et al., 2021).

Widening our perspective beyond the COVID-19 pandemic, conspiracy theories tend to appear during social crises to cope with collective uncertainty and fear (van Prooijen and Douglas, 2017; Larson, 2020). Conspiracy theory emergence can be seen as an attempt to make complex and threatening situations more understandable and predictable (Franks et al., 2013). It is in keeping with this general pattern that Freeman et al. (2020) identified an increased emergence of conspiracy theories in the United Kingdom during the COVID-19 pandemic. Schließer and colleagues (2020) report similar tendencies for Germany. However, they highlight that a high conspiracy mentality has long been evident in Germany, which is now becoming more overt, e.g., through the *Querdenker* protest movement that unites a multitude of sociodemographic groups with a high conspiracy mentality.

Studies have shown that the belief in vaccination conspiracies has real-life consequences for health-related behaviours. Jolley and Douglas (2014) found a significant negative relationship between anti-vaccination conspiracy beliefs and intentions to have a fictitious child vaccinated in a United Kingdom-based study. They further describe the mediating role of the perceived danger of vaccines, feelings of powerlessness, and mistrust in authorities. In the COVID-19 context in the United Kingdom and Turkey, Salali and Uysal (2020) found that believing in a natural (wildlife) origin of the coronavirus significantly increased odds of COVID-19 vaccine acceptance compared to believing in an artificial origin (e.g., originated in a laboratory). Additionally, susceptibility to misinformation was associated with a significant decrease in the likelihood to get vaccinated and recommending the vaccination to vulnerable friends and family in the United States, the United Kingdom and Mexico (Roozenbeek et al., 2020).

It is likely that the relationship between belief in vaccination conspiracy theories and vaccination intentions is tied to a general psychological tendency to believe in conspiracies, as has been

shown by Lewandowsky et al. (2013). Their model, based on US data, revealed that the endorsement of ‘classic’ conspiracy beliefs (e.g., about the Moon Landing) is also associated with negative attitudes toward vaccines. Furthermore, all investigated conspiracy theories had similar predictors. They found a negative correlation with political trust, political knowledge, and education, as well as a positive correlation with authoritarianism. Conspiracy beliefs, as well as a conspiracy mentality, negatively predicted participants’ intentions to be vaccinated against COVID-19 in a French sample (Bertin et al., 2020). This is consistent with earlier studies which have found an interconnectedness of different conspiracy beliefs, pointing to the existence of a general “Conspiracy mentality” (Moscovici, 1987; Bruder et al., 2013).

Although negative correlations between the belief in (vaccination) conspiracies and vaccination intentions have been repeatedly established (Lewandowsky et al., 2013; Jolley and Douglas, 2014; Bertin et al., 2020; Roozenbeek et al., 2020; Salali and Uysal, 2020), the effect size remains modest, ranging between $r^2 = 0.05$ (Bertin et al., 2020) and $r^2 = 0.27$ (Lewandowsky et al., 2013). Much of the variance still needs to be explained and to the authors’ knowledge, the topic has not been investigated within Germany before. Filling this gap in times in which a long documented high conspiracy mentality in Germany (cp. Schließer et al., 2020) is discussed in public more openly (e.g., through the *Querdenker* movement) seems to present a unique opportunity. What could also foster conspiracy mentalities in the current pandemic is the organization of vaccinations in Germany. Initially, these were organized centrally in vaccination centers (which are still in operation) before general practitioners were also allowed to vaccinate. This could be particularly relevant as GPs in Germany have been shown to have had a central role in vaccination in terms of trust (Rehmet et al., 2002).

This study thus aims to reveal the specific dimensions of the vaccine-related conspiracy belief and its links to other beliefs and socio-demographic characteristics. It is important to assess if the same correlations hold in the German context, as well as the current, dynamic and ever-evolving COVID-19 vaccination debate. Specifically, we aim to answer the following questions:

1. What are the predictors of belief in the mandatory vaccination conspiracy?
2. How heavily correlated is belief in the mandatory vaccination conspiracy with others and with general conspiracy-mindedness?
3. How heavily correlated is the belief in the mandatory vaccination conspiracy with vaccination intentions?

METHODS

Sampling and Data Management

In this study, we examined relevant items from a nationally representative survey which was conducted from October 30, 2020 to December 14, 2020 in Germany as part of the *Viral Communication* project (viralcomm.info).

Participants were recruited by sending postcard invitations to a random selection of 30,000 households, using the German postal service's (Deutsche Post) address database. Addresses were stratified by population across federal states in Germany (Destatis, 2020). Following data collection, survey data was cleansed by applying a range of inclusion criteria. Valid cases needed to include non-missing responses for *age group*, *sex*, *nationality group* (German/other), *migration background*, *federal state*, *highest school leaving qualification*, and *highest professional qualification*. These criteria were strictly required as weighting was applied next, using the latest available German census (Zensus 2011, 2011). This meant that these key sociodemographic questions were asked exactly as they were in the census, and that the sample was then weighted based on the corresponding sociodemographic distributions from the latest German census so as to represent the German population as accurately as possible. All questions used for weighting had therefore been exactly aligned with their census counterparts in the survey design stage. The weighted dataset allows for inferences beyond the sample.

In total, 1,480 survey entries were registered. 547 participants were excluded for not fitting the inclusion criteria, and 208 participants did not answer the vaccination conspiracy item. The final sample had $N = 725$ participants ($n_{\text{woman}} = 421$, $M_{\text{age}} = 48.9$, $SD = 18.8$).

Survey Design

For each of the survey items described below, participants were given a "Not applicable/No Opinion" response option.

COVID-19 Conspiracy Beliefs and Conspiracy Mentality

Different COVID-19 conspiracy beliefs were assessed using a standard 7-point Likert-type scale, ranging from "Strongly Disagree" to "Strongly Agree", with "Neutral" as the midpoint (used throughout the survey). Respondents were asked to indicate their level of agreement with certain statements, including the vaccination conspiracy belief in the center of our analysis, namely "*The coronavirus (COVID-19) is part of a global effort to enforce mandatory vaccination*". Other conspiracy beliefs tested for correlation with the primary item above are "*The coronavirus (COVID-19) was bioengineered in a military lab*", "*The new 5G network is making us more susceptible to the virus*", "*The coronavirus (COVID-19) is a hoax*", and "*The Coronavirus (COVID-19) originated in a Chinese lab*".

Based on the Conspiracy Mentality Questionnaire (CMQ) by Bruder and colleagues (2013), a four-item scale was developed to assess general conspiracy mindedness. The questions were adapted to the specific context of the COVID-19 pandemic, including items such as "*The Coronavirus (COVID-19) situation has provided an excuse for government agencies to closely monitor all citizens*" and "*Many important decisions about the Coronavirus (COVID-19) situation are made without the public ever being informed*". Respondents were able to rate all items on the aforementioned agreement scale. A conspiracy mindedness score was calculated for each participant by taking the average of all answered conspiracy items listed above.

Vaccination Intentions

A 5-point Likert-type scale ranging from "Definitely not" to "Definitely", with "Maybe" as the midpoint, was used to assess participants' willingness to voluntarily vaccinate against COVID-19, using the following question: "*Would you take the following measures on a voluntary basis?*"

Trust in Political and Scientific Actors

To measure trust in key institutional sources of information on the pandemic (i.e., RKI, WHO, respective state government, German Public Health Ministry, German health minister Jens Spahn, German virologist Christian Drosten and Angela Merkel), respondents were asked to rate their level of trust on a 5-point Likert-type scale ranging from 'Completely distrust' to 'Completely trust', with 'Neutral' as the midpoint.

Accessing Information on Social Media

For measuring the frequency at which people access information about the COVID-19 situation on different social media and messaging platforms, respondents were first asked which platforms they used, followed by a 7-point Likert-type scale (ranging from 'Never' to 'Always', with 'Sometimes' as the midpoint) for each selected platform. The platforms included were Facebook, YouTube, Twitter, Instagram, and the messaging services WhatsApp, Threema or Telegram.

Data Analysis

To ascertain predictors of belief in the vaccination conspiracy, correlation analyses and independence tests were performed with socio-demographic variables, trust in different COVID-19 information sources, and political orientation as independent variables. Due to the ordinal nature of the dependent variable, Kendall's Tau was used to identify non-parametric correlations with other ordinal or interval variables. Kruskal-Wallis and corresponding post-hoc tests with Bonferroni correction were used for nominal independent variables. Compound variables for attitudes towards science, trust in scientific actors and conspiracy-mindedness were computed by taking the average of the relevant (and responded-to) items. Throughout this paper, statistically significant results are reported at $\alpha < 0.05$.

RESULTS

75% of people in Germany, 95% CI (0.724, 0.784), disagreed with the statement that "the coronavirus is part of a global effort to enforce mandatory vaccination", with the response option *Strongly Disagree* representing the median as well as the mode at 52%, 95% CI (0.482, 0.552). Yet, there was a notable 15% minority of people, 95% CI (0.127, 0.178), who at least somewhat agreed with this statement. The sub-proportions of people who agreed with the conspiracy belief were 6% for "somewhat agree", 95% CI (0.046, 0.080), 7% for "agree", 95% CI (0.053, 0.089), and 2% for "strongly agree", 95% CI (0.009, 0.027).

Sociodemographic Predictors

There were significant differences in levels of agreement with this statement on the basis of geographical location by federal state

within Germany, $H(15) = 130.826$, $p < 0.001$, $\eta^2 = 0.17$. Overall, geographical location within Germany explained 16.6% of variance in level of agreement with this vaccine conspiracy belief. The following effects were particularly high: Berlin (mean rank = 199.81) scored consistently low compared to Schleswig-Holstein (mean rank = 430.33), $Z = -4.329$, $p = 0.002$, $r = 0.57$, and Brandenburg (mean rank = 448.07), $Z = -4.460$, $p = 0.001$, $r = 0.60$. Similarly, Rheinland-Pfalz (mean rank = 206.43) scored considerably lower than Schleswig-Holstein, $Z = -4.278$, $p = 0.002$, $r = 0.53$, and Brandenburg, $Z = 4.410$, $p = 0.001$, $r = 0.56$.

Although there was no noteworthy correlation with age, $r_\tau = -0.07$, $p = 0.002$, between different age groups, there were statistically significant differences, $H(7) = 20.098$, $p = 0.005$, $\eta^2 = 0.02$. However, age groups as a whole explained just 2.0% of variance in agreement with the vaccine conspiracy belief. The only at least moderate significant pairwise comparison between age groups responsible for the significant Kruskal-Wallis H test was the difference between people aged 80+ and 30–39 year-olds, $Z = 4.235$, $p = 0.001$, $r = 0.33$. Specifically, 30% of people in Germany between 30 and 39 years of age, 95% CI (0.210, 0.386), agreed to some degree that the coronavirus is a global effort to enforce mandatory vaccination, while only 8% within the 80+ category, 95% CI (0.005, 0.158), agreed with this statement.

There was a statistically significant effect on the basis of school leaving qualification, $H(4) = 64.685$, $p < 0.001$, $\eta^2 = 0.09$, which explained 8.6% of variance in vaccine conspiracy belief agreement overall. However, the only moderate effect size identified based on school leaving qualification was between people with an Abitur, the highest secondary degree in Germany (mean rank = 258.30), and people with a Volksschule-diploma, a lower-level secondary degree (mean rank = 418.32), $Z = 7.841$, $p = 0.002$, $r = 0.36$, explaining 13% of the variance.

Gender did not play a major role in belief in this conspiracy as only 3% of the variance is attributable to this variable, $U = 52,180.50$, $p < 0.001$, $r = 0.17$, $\eta^2 = 0.03$. German residents with a migration background, on the other hand, were more likely to believe in the vaccine conspiracy than people without a migration background, $U = 25,326.50$, $p < .001$, $r = .30$, $\eta^2 = .09$, accounting for 9% of the variance. Specifically, we found 43% of people with a migration background, 95% CI (0.349, 0.506), agreed to some extent with the vaccine conspiracy statement, whereas just 9% of people without a migration background, 95% CI (0.064, 0.108), agreed.

There was only a negligible correlation with political orientation, $r_\tau = 0.11$, $p < 0.001$, with only 1.2% of the variance explained. However, a Kruskal-Wallis test revealed significant differences between different self-affiliated political groupings, $H(6) = 39.547$, $p < 0.001$, $\eta^2 = 0.05$ (5.3% shared variance). The only group responsible for the significant result seems to have been the far-right group, $Mdn = 6$ (Agree): Especially compared to the far-left group, $Z = -4.261$, $p < 0.001$, $r = 0.73$ (53.4% shared variance), but also compared to second-farthest right group, $Z = -3.246$, $p = 0.025$, $r = 0.56$ (31% shared variance), people who categorized themselves as far-right scored substantially higher. Differences on the basis of highest

professional qualification were only marginal, accounting for just 4% shared variance, $H(5) = 32.506$, $p < 0.001$, $\eta^2 = 0.04$.

Attitudinal and Behavioral Predictors

To a moderate degree, attitudes toward science were negatively correlated with the belief in the vaccine conspiracy, $r_\tau = -0.32$, $p < 0.001$: People with more positive attitudes toward science were less likely to agree with the conspiracy statement (10.2% of variance explained). Also, trust in key scientific and official information sources was negatively correlated with this conspiracy belief. This applies to the German Public Health Ministry, $r_\tau = -0.34$, $p < 0.001$ (12.6% shared variance), pandemic-relevant research organizations such as the Robert Koch Institute, $r_\tau = -0.33$, $p < 0.001$ (10.9% of variance explained), prominent researchers such as virologist Christian Drosten, $r_\tau = -0.30$, $p < 0.001$ (9% of variance explained), as well as the WHO, $r_\tau = -0.30$, $p < 0.001$ (9% shared variance). Trust in scientific institutions (compound variable including trust in Christian Drosten, the WHO, and the Robert Koch Institute) was moderately correlated with attitudes toward science, $r_\tau = 0.36$, $p < 0.001$ (13% of variance accounted for).

An additional interesting finding was that people who felt less informed about science were more likely to agree with the vaccination conspiracy, $r_\tau = -0.32$, $p < 0.001$, explaining 10.2% of variance.

The correlation between the frequency in accessing a social media or messaging platform and the agreement with the vaccine conspiracy varied greatly by platform. The frequency of using Twitter was strongly correlated with vaccine conspiracy agreement, $r_\tau = 0.57$, $p < 0.001$, with 32.3% of variance explained. However, when comparing the correlation between people with and without migrant backgrounds, there were only significant findings for the group with migrant backgrounds, $r_\tau = 0.56$, $p < 0.001$, compared to $r_\tau = 0.32$, $p = 0.122$. Usage of messaging apps such as WhatsApp, Telegram or Threema was only moderately correlated with vaccine conspiracy belief, $r_\tau = 0.32$, $p < 0.001$. Using Facebook, $r_\tau = -0.05$, $p = 0.44$, and YouTube, $r_\tau = 0.03$, $p = 0.66$, were not correlated with this conspiracy belief. Instagram usage was only weakly correlated with the conspiracy belief, $r_\tau = 0.19$, $p = 0.028$.

Belief in the conspiracy idea that the coronavirus is a global effort to enforce mandatory vaccination correlated strongly with general conspiracy-mindedness, $r_\tau = 0.50$, $p < 0.001$. While this was to be expected, only 25% of variance was explained.

Additional correlations with belief in other conspiracy beliefs further support the interconnectedness of various conspiracy beliefs: A strong correlation with 30.5% shared variance was established with belief in the conspiracy that “the coronavirus is a hoax”, $r_\tau = 0.55$, $p < 0.001$, that “the coronavirus was bioengineered in a military lab”, $r_\tau = 0.47$, $p < 0.001$ (21.9% shared variance), that “the new 5G network is making us more susceptible to the virus”, $r_\tau = 0.47$, $p < 0.001$ (22.5% shared variance), and that “the coronavirus originated in a Chinese lab”, $r_\tau = 0.32$, $p < 0.001$ (10.4% shared variance). Further, the notably strong correlation with belief that “the coronavirus is a hoax” significantly differed from the moderate correlations with the

other conspiracy beliefs: $z = 2.106, p = 0.035, z = 1.972, p = 0.049$, and $z = 5.062, p < 0.001$, respectively.

Behavioral Effects

We found a negative correlation between agreement with the vaccine conspiracy and willingness to take a voluntary COVID-19 vaccination, $r_t = -0.29, p < 0.001$. The less people in Germany believed the vaccination conspiracy, the more likely they were to express willingness to take the novel coronavirus vaccine. However, the effect size here was moderate, with 8.4% of variance shared.

DISCUSSION

This study has analyzed survey results on a vaccination-related conspiracy belief, its predictors and links to willingness to get vaccinated. This article's jumping off point is that in Germany a notable 15% minority of people at least somewhat agreed with this statement "the coronavirus is part of a global effort to enforce mandatory vaccination."

People from the German capital of Berlin were less likely to agree with the vaccination conspiracy than people from another part of Germany (i.e., the state of Brandenburg). Demographic variables do not seem to explain these differences since Berlin has a younger and more migrant population than Brandenburg, where both factors tend to enhance agreement with the vaccination conspiracy (Statistik Berlin Brandenburg, 2019). These state differences may instead be related to political party affiliation patterns (e.g., right-wing oriented parties have a larger following in Brandenburg than in Berlin), given that people identifying as far-right politically tended to support the vaccination conspiracy belief. Additionally, measures in the more densely populated city-state Berlin are more visible and partly stricter than the ones in Brandenburg, e.g., already in October 2020 Berlin introduced a mask requirement in some squares and busy streets while in Brandenburg this was only introduced in the capital Potsdam. Thus, preliminarily, more or less strict policies could be a factor in regional differences. Of course, other factors related to state differences such as local press need to be taken into account - a potential focus of future studies.

Political orientation on a conventional left-right spectrum only negligibly correlated with the vaccine-related conspiracy belief. These findings are consistent with results from Sutton and Douglas (2020) suggesting that conspiracy beliefs are associated with ideological polarization rather than liberalism or conservatism. Other studies have highlighted the relevance of factors such as lack of recognition, political deprivation, a negative assessment of the economic situation and right-wing extremism (Schließler et al., 2020). However, a larger proportion of variance can be explained by the level of secondary education attained. Overall, age only has a minor influence, with 30–39 year-olds particularly "susceptible" to such beliefs. This age-specific finding may raise concerns given research showing that people aged 20–49 were responsible for 65% of SARS-CoV-2 infections in the US (Monod et al., 2021).

Existential motives for believing in a conspiracy belief, such as feeling safe and in control of one's environment, tend to be

important in the context of a new vaccine (Douglas et al., 2017). People who feel a lack of instrumental control may seek this feeling of "safety" by rejecting official narratives and believing in a specific conspiracy (Goertzel, 1994). This may help explain why marginalized groups often subscribe to conspiracies at the highest frequency. In our research, 43% of people with a migration background agreed to some extent with the vaccine conspiracy statement, whereas just 9% of people without a migration background did the same. The difference between people with a migrant background and those without one could also be explained by exposure to misinformation: Although there was a general correlation between Twitter usage and vaccination conspiracy belief, it was only statistically significant for people with a migrant background. Future studies could more deeply investigate information behavior and the sources accessed among both groups as potential causes for this effect.

Trust in all types of information sources (i.e., governmental, scientific, and international) was a consistent factor related to belief in the vaccine conspiracy - less trust in various institutional information sources meant a higher tendency to believe in the conspiracy. This coheres with literature on the relation between conspiracy belief and distrust in governments (Sutton and Douglas, 2020) as well as specific institutions and professions (Freeman et al., 2020). The direction of causality, however, remains unclear. That is, we don't know from this study whether belief in conspiracies are responsible for distrust, whether there is an inverse effect, or whether they are mutually reinforcing.

This study found, in line with previous research, a high correlation between belief in the vaccination conspiracy and general conspiracy-mindedness, as well as moderate to strong correlations with other specific conspiracy beliefs. These findings support the established principle of interconnectedness of conspiracy beliefs (Goldberg and Richey, 2020; Uscinski et al., 2020), albeit with substantial unexplained variance.

Conspiracy beliefs tend to conform to characteristics of conspiracy mentality (hence the strong correlation to specific conspiracy beliefs), in which nothing is as it seems, everything is connected and a network of actors with evil intentions are driving events (Burkun, 2013). Moscovici (1987) points out that it is typically a "minority" that is held responsible for great upsets and social crises. In the case of the current pandemic, the strong correlation between vaccine conspiracy belief and agreement that "the coronavirus is a hoax" as well as an opposing belief that it "originated in a Chinese lab" implies conspiracy narratives which squarely fit the historical mold: The coronavirus pandemic would be used to enforce vaccination as part of a carefully orchestrated hoax or China's bad intentions. Yet, there are also variations that need to be accounted for by how they connect with local belief systems and existing relationships between groups. For example, belief in the conspiracy idea that "the coronavirus originated in a Chinese lab" (34% agreement) was relatively high in Germany, while belief that 'the coronavirus is a hoax' (3% agreement) was not.

We demonstrate that the belief in a vaccination conspiracy can affect people's health behaviors during the COVID-19 pandemic. This is in line with previous research reporting a negative

relationship between the belief in (vaccination) conspiracies and vaccination intentions in the United States, United Kingdom, France, Mexico, and Turkey (Bertin et al., 2020; Lewandowsky et al., 2013; Jolley and Douglas, 2014; Roozenbeek et al., 2020; Salali and Uysal, 2020). Hence, targeting vaccine conspiracy beliefs should also be an important factor in the efforts to increase vaccination intentions within Germany for the benefit of public health.

Nonetheless, we are not able to explain the causal direction of effects in this study, meaning that either the belief in the vaccination conspiracy could reduce vaccination intentions, or that low vaccination intentions might increase belief in the vaccination conspiracy belief. Therefore, an important next step for future studies would be to explore people's vaccination intentions in more detail (e.g., *via* follow-up interviews) to more closely follow the argumentation behind the intentions/hesitations to get vaccinated, and find out whether conspiracy thinking is used to justify the decision being made. Longitudinal research, which is also planned for the project underpinning this article, will also help to tease apart correlation and causation on this topic.

Our findings indicate potential value in focusing COVID-19 vaccine engagement on the sociodemographic groups most susceptible to vaccine conspiracy beliefs, specifically people in Schleswig-Holstein and Brandenburg, people between 30–39 years of age, people with a Volksschule degree, and those with a migration background. Additionally, policies and (science) communication on the governmental and institutional level should aim to establish and maintain long-term, mutually beneficial relationships of trust with diverse publics (see e.g., Borchelt and Nielsen, 2014) to potentially inhibit the intake of

misinformation leading to conspiracy beliefs and an adverse course of the pandemic.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: <https://zenodo.org/record/4590017>.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of the Sigmund Freud University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors contributed to the survey design. AP and LL set up the survey system. Data collection was conceptualized by EJ, BW, and MW and implemented by LL. AP performed the data management and statistical analyses. LH with input from BW and MW wrote up the introduction. AP and LH wrote up the methods. AP wrote up the results. EJ, AP, LH, BW, and MW wrote up the discussion and together with LL contributed with general editing. EJ did final editing.

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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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