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Examining the Role of COVID-19 Conspiracy Beliefs in Predicting Vaccination Intentions, Preventive Behavior and Willingness to Share Opinions about the Coronavirus

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The primary aim of our study was to examine the role of COVID-19 conspiracy beliefs in predicting outcomes that could potentially worsen the course of the pandemic: preventive behavior, vaccination intentions and willingness to share COVID-19 related opinions. Structural equation modeling was performed on a Slovenian sample (N = 490). Analysis showed that COVID-19 conspiracy beliefs predicted all three health-related outcomes when sociodemographic variables were controlled for. Further, a perceived coronavirus threat was identified as an important mediating factor between conspiracy beliefs, preventive behavior and vaccination intentions. Conspiracy beliefs were also positively associated with age, female gender, religiosity, and share of COVID-19 information from social media, while they were negatively associated with level of education. The results suggest that COVID-19 conspiracy beliefs may be an important barrier to achieving pandemic management goals and highlight some risk factors for their occurrence.

Key words: COVID-19, conspiracy beliefs, preventive behavior, vaccination, willingness to share opinions

Introduction

While the technical side of any crisis can be addressed by allocating funds and appropriate sources to critical infrastructure, which in times of COVID-19 pandemic can be challenging on its own, the willingness to use those resources seems to be a less considered side of the predicament. Theoretically sound and scientifically supported actions might not have the desired effect if they are not widely adopted. Since people's behavior is likely to be influenced by their backgrounds and worldviews, the endorsement of conspiracy theories may be one of the greatest threats to public health during the pandemic of COVID-19.

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The data that support findings of this study, R-code for analysis and all research materials are available in OSF repository at https://osf.io/hpcet/?view_only=45c7edb2324d4b8db0ca627238d465e5

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Conspiracy theories can be defined as beliefs, which are based on attributing the causes of important social and political events to the plotting of secret influential organizations or groups of powerful individuals (Douglas et al., 2019). The emergence of conspiracy theories is often associated with social crises, such as natural disasters, terrorist attacks, financial instabilities, and the spread of new diseases (van Prooijen & Douglas, 2017). These types of complex, unpredictable, and difficult-to-understand situations evoke anxiety and increase levels of distress (Salari et al., 2020), thus enhancing motivation to alleviate the experienced negative feelings and consequently increasing susceptibility to conspiracy theories as they reduce uncertainty and help people make sense of the situation.

Preventive Behavior

Conspiracy beliefs have been found to predict numerous behavioral outcomes, ranging from lower pro-environmental behavior (van der Linden, 2015) to attacks on 5G mobile network infrastructure (Ahmed et al., 2020). In the case of the COVID-19 pandemic, prosocial behavior is decisive as it relates to the adoption of hygienic and social distancing measures that are critical for reducing the spread of the coronavirus and its adverse consequences. Previous research has shown that belief in COVID-19 conspiracy theories is associated with lower support of public health policies and government guidelines to control the coronavirus transmission (Earnshaw et al., 2020; Pummerer et al., 2020), and self-reported adherence to these guidelines (Erceg et al., 2020; Freeman et al., 2020; Pummerer et al., 2020), however, the results are not entirely conclusive. For example, Alper et al. (2020) found that the COVID-19 conspiracy beliefs were not related to levels of adherence to preventive measures, and Earnshaw et al. (2020) reported that conspiracy beliefs did not predict adherence to health recommendations when sociodemographic factors and COVID-19 knowledge were controlled for.

Vaccination Intentions

Another important way to reduce the number of new coronavirus infections emerged in late 2020, when COVID-19 vaccines became available to the public. As previously shown, anti-vaccine conspiracy beliefs may be detrimental to vaccination intentions (Jolley & Douglas, 2014). Similar conclusions can also be drawn in the case of the COVID-19 conspiracy beliefs which were found to be related to lower COVID-19 vaccine acceptance (Bertin et al., 2020; Freeman et al., 2020). Therefore, those beliefs might have the capacity to prevent even the countries with sufficient amounts of COVID-19 vaccines from reaching their vaccination goals, which would relieve their healthcare systems, reduce mortality rates and revive the economy by loosening imposed restrictions. In the European Union an important vaccination threshold of 70% of the adult population was reached on August 31 (European Commission, 2021, August 31), however large discrepancies can still be observed between countries, especially of Western and Eastern Europe (ECDC, 2021, September 28). For example, the highest vaccination coverage rate is 90.7% in Iceland and the lowest is in Bulgaria with only 22% (ECDC, 2021, September 28). Data therefore suggest there might be other important reasons for such trends that are not limited solely to vaccine availability. Similarly, in the United States of America, the percentage of people vaccinated against COVID-19 was 63.5% as of September 27, 2021, however, the vaccination rate appears to be slowing down (ECDC, 2021; Ritchie et al., 2021), requiring further research for better understanding and prevention of this worrying trend.

Willingness to Share Opinions

Conspiracy beliefs might also result in a tendency to overshare them with the social environment. Positive association between conspiracy beliefs and willingness to share them with others could pose a serious problem as it could set in motion a virtuous cycle in which more and more people hold and act on these beliefs, thus potentially endangering public health. Although scarcely researched, certain findings support the above claim. For example, Lobato et al. (2020) reported that people with higher levels of general conspiracy mentality are more likely to spread misinformation about COVID-19. Similarly, Freeman et al. (2020) found that those who hold COVID-19 conspiracy beliefs are less reluctant to share their opinions. Thus, research to date suggests a positive relationship between conspiracy beliefs and behavioral tendencies that could lead to their prevalence. However, further research is needed to further delineate the role of conspiracy mentality in the spread of conspiracy theories.

Potential Mediators of COVID-19 Conspiracy Beliefs' Effects on Health-related Outcomes

Perceived Risk

COVID-19 conspiracy theories often include elements such as the denial of the new coronavirus's existence and claims that the pandemic is fabricated or at least exaggerated, comparing it to an ordinary outbreak of the flu (Freeman et al., 2020). Therefore, it is expected that those with higher conspiracy mentality who are more prone to adopting such beliefs will also perceive the new coronavirus as less dangerous, which was also indicated in some previous studies (e.g., Ejaz et al., 2021). On the other hand, low perceived threat of the new coronavirus may lead to disapproval of government measures to prevent its spread (Franzen & Wöhner, 2021) and low engagement in preventive behaviors or willingness to get vaccinated (Freeman et al., 2020). Hence, some researchers have already tested the assumption that perceived risk of the new coronavirus mediates the relationship between conspiracy beliefs and health-related behavior. For example, Romer & Jamieson (2020) found that conspiracy beliefs predicted adoption of preventive measures and vaccination intentions both directly and indirectly through the perceived threat of the coronavirus, whereas Marinthe et al. (2020) and Chayinska et al. (2021) showed that only the indirect effects through perceived risk were significant.

Trust in Science

Conspiracy mentality, operationalized as a general tendency to believe in different conspiracy theories (Brotherton et al., 2013), has been previously shown to correlate with distrust in experts (Imhoff et al., 2018), possibly due to their perceived status of a deceitful elite. In line with this finding, the COVID-19 pandemic gave rise to numerous conspiracy theories emphasizing scientists' involvement in its onset and persistence. Being the main sources of information about the characteristics of the virus and its possible threats to public health while also leading vaccine development and providing counselling to governments in the process of developing preventive measures, scientists are likely to be perceived as an outgroup with sinister intentions by those with a more pronounced conspiracy ideation. This assumption has also been empirically tested, with some of the previous research reporting that trust in science and COVID-19 conspiracy beliefs are highly inversely correlated (Tonković et al., 2021).

On the other hand, research also suggests that lower trust in science is related to less adherence to those health-related guidelines that scientists helped to create (Chayinska et al., 2021). Therefore, the mediating role of trust in science in the relationship between COVID-19 conspiracy beliefs and health-related behaviors should also be examined. Some previous findings suggest that trust in science fully mediates the relationship between general conspiracy mentality and preventive behavior (Plohl & Musil, 2020), however, further work is needed to delineate the relationships between COVID-19 conspiracy beliefs, trust in science and different health behaviors.

Risk Factors for COVID-19 Conspiracy Beliefs

Thus far, we have described the existing research on the potential role of the COVID-19 conspiracy beliefs in various behaviors that may pose a public health risk. Assuming that belief in conspiracy theories is indeed related to undesirable behaviors, we might also recognize the importance of examining the risk factors for the emergence of conspiracy ideation in order to adapt existing communication and awareness efforts to make the necessary COVID-19 interventions additionally focused on people who are more prone to conspiracy beliefs.

According to the interpretation of Bruder et al. (2013), women might be more inclined to conspiratorial thinking, especially in societies where they are systematically deprived, as powerless individuals tend to succumb to conspiracy theories faster (Abalakina-Paap et al., 1999). However, research on COVID-19 conspiracy beliefs and gender has shown mixed results (Cassese et al., 2020; Alper et al., 2020; Freeman et al., 2020). Regarding age, similar explanation was provided by Romer & Jamieson (2020), who reported on the negative correlations between age and conspiracy beliefs. COVID-19 conspiracy beliefs could also be less pronounced in individuals with higher education, possibly due to the fact that analytical thinking, which was previously found to be negatively related to conspiracy beliefs (Swami et al., 2014), is developed through education. Indeed, several researchers reported that individuals with lower education exhibited more conspiracy beliefs (Georgiou et al., 2020; Romer & Jamieson, 2020; Tonković et al., 2021). Previous research has also shown that those who are more religious or consider religion as more important are more likely to hold COVID-19 conspiracy beliefs (Alper et al., 2020; Tonković et al., 2021). Reasons for such findings could be found in several shared traits between conspiracy and religious beliefs, such as black and white dualism, promoting narratives of hidden powers governing important world events and presenting themselves as prophetic, thus offering salvation from evil agendas (Dyrendal, 2020).

Technological advances in recent decades have introduced new modes of communication, thus also facilitating the spread of conspiracy theories (Vosoughi et al., 2018). Social platforms such as Facebook, YouTube, and Twitter are widely known for dispersion of misinformation and conspiracy ideas (Kouzy et al., 2020; Stecula & Pickup, 2021) as they impose weaker restrictions on shared content compared to the traditional media, allowing it to spread faster (Gallotti et al., 2020; Hollander, 2017). According to the described findings, those who use social media as primary sources of information should have stronger conspiracy beliefs. Indeed, several authors have shown that social media use is associated with COVID-19 conspiracy beliefs, whereas traditional media use was associated with less pronounced conspiracy ideation (Allington et al., 2020; De Coninck et al., 2021; Freeman et al., 2020; Romer & Jamieson, 2020).

The Present Research

Although some exploratory findings already suggest that conspiracy beliefs may have serious consequences for public health, research on the relationship between conspiracy beliefs and health-related outcomes in the context of the global pandemic has provided somewhat mixed results. Therefore, our aim was to contribute to existing knowledge and possibly clarify some of the previous ambiguous findings by systematically examining the role of COVID-19 conspiracy beliefs in predicting preventive behavior and vaccination intentions. Additionally, predictive value of conspiracy beliefs regarding willingness to share opinions about the new coronavirus was also explored while controlling for several sociodemographic factors, which to our knowledge has not been previously conducted.

In line with existing literature, we hypothesized that COVID-19 conspiracy beliefs will be a statistically significant predictor of COVID-19 preventive behavior (H1), COVID-19 vaccination intentions (H2) and willingness to share opinions about the new coronavirus (H3). Based on some previous findings, we also assumed that the relationship between COVID-19 conspiracy beliefs and COVID-19 preventive behavior will be mediated by perceived dangerousness of the coronavirus (H4a) and trust in science (H4b) and that the relationship between COVID-19 conspiracy beliefs and COVID-19 vaccination intentions will also be mediated by both the perceived dangerousness of the coronavirus (H5a) and trust in science (H5b).

Since previous research suggested that at least some of the risk factors for COVID-19 conspiracy beliefs may differ between countries (e.g., gender), our additional goal was to examine which sociodemographic variables are associated with COVID-19 conspiracy beliefs in the Slovenian population and how this information can be interpreted in the context of other international findings. Considering the important role social media are believed to play in forming conspiracy beliefs, we also explored whether the share of COVID-19 related information obtained through social media predicts the strength of COVID-19 conspiracy beliefs.

Method

Participants and Procedure

The survey was conducted between March 29 and April 7, 2021, during the third wave of COVID-19 infections in Slovenia. Data was collected using an online questionnaire distributed among students at the University of Ljubljana and in various Facebook groups, some of which were specifically dedicated to the discussion of the COVID-19 and related topics. Participation was completely voluntary, and anonymity of the collected data was guaranteed. No compensation was offered in exchange for participation in the study. Participants provided informed consent before the survey began. The study was conducted in accordance with the Declaration of Helsinki. Ethical review and approval were not required for this study in accordance with national and institutional guidelines.

Minimum sample size of 400 participants was determined by an online a-priori sample size calculator for structural equation models (Soper, 2021) with power criterion of 80%, alpha significance criterion of .05 and expected effect size of .05. The obtained sample consisted of 940 Slovenian-speaking participants, of whom 511 (54.4%) completed the questionnaire. The data was thoroughly checked for inconsistencies and possible intentional falsifications, which were considered to be possible due to the nature of the studied phenomenon. This resulted in 21 individuals being

excluded from further analysis. The final sample consisted of 490 participants, 397 women (81.0%), 92 men (18.8%), and one non-binary individual (0.02%). Their mean age was 35.7 years and ranged from 18 to 70 years (*SD* = 13.2). Most of the participants were well-educated, as 56.5% of them reported having a college degree, while 41.8% of them had a high school diploma and 1.6% had completed only elementary school. By employment status, 31.6% of the participants reported being students, 54.7% were employed, 9.0% were unemployed, and 4.7% were retired. When asked about the predominant living environment, 53.7% of participants reported living mostly in urban areas, while 46.3% lived mostly in rural areas.

Measures

Demographics

To obtain the participants' demographic data, the survey included a series of questions on their gender, age, highest level of education attained, total number of years of formal education, employment status (student, employee, unemployed, retired), and predominant living environment (urban, rural).

Religiosity Measure

Religiosity was measured with a single item (*I would define myself as a religious person.*). Participants rated their agreement with the statement on a 7-point Likert scale, ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*).

Share of COVID-19 Information Received via Social Media

To measure the share of COVID-19 information received via social media, we used an interactive slider powered by our online survey provider and asked participants to move it to the estimated percentage of information about COVID-19 they received via social media such as Facebook, Instagram, Twitter, Snapchat, and TikTok. The slider allowed them to choose any integer between 0 and 100 and therefore provided us with distinct numerical estimates.

Perceived Dangerousness of the New Coronavirus

Perceived dangerousness of the new coronavirus was measured with a single item (*New coronavirus poses a serious threat to people's health*). Participants were asked to rate their level of agreement with a presented statement on a 7-point Likert scale with anchors, 1 (*Strongly disagree*) and 7 (*Strongly agree*).

Trust in Science

Trust in science was measured using the 21-item Trust in Science and Scientist Inventory (Nadelson et al., 2014). Participants rated their agreement with given statements (e.g., *We should trust the work of scientists*.) on a 5-point Likert scale, ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*). Confirmatory factor analysis (CFA) showed the model did not fit the data well, so item 11 was excluded due to its poor semantic differentiation from the items 10 and 9 and some covariances between the residuals of other semantically similar items were allowed. The modified 20-item scale exhibited acceptable fit: $\chi^2(166) = 484.642$, $p < .001$, CFI = .939, TLI = .930, RMSEA = .070, 90% CI: [.063, .078], SRMR = .042. The internal consistency of the shorter version of the scale was excellent ($\alpha = .95$).

COVID-19 Conspiracy Beliefs

To measure COVID-19 conspiracy beliefs, we developed a 14-item scale based on the most

widespread conspiracy theories about the appearance and spread of the new coronavirus that circulated in the Slovenian population but were not specific to Slovenian culture and were also observed in other countries (e.g., *The new coronavirus was artificially created in a laboratory,* see Appendix A in online supplemental materials). Following Bruder et al. (2013), we used an 11-point response scale and asked participants to rate their level of certainty that each item was true using anchors, 0 (*0% – Certainly not*) and 10 (*100% – Certain*). Exploratory factor analysis (EFA) yielded a two-factor solution. The first factor represented beliefs about the origin of the new coronavirus and political or financial motives of its presumed creators, while the second factor was more difficult to interpret as it contained items related to conspiracies that connect the pandemic with technologically induced or manual body interventions (such as 5G, microchip insertion, etc.). Item 12 was excluded due to cross-loading and the obtained model was further estimated by CFA. In order to achieve an acceptable fit, item 1 was omitted having the lowest loading and some semantically feasible residual covariances were allowed according to modification indexes. As the obtained factors were highly correlated and we were more interested in the general aspects of COVID-19 conspiracy beliefs, a second order factor was extracted, which was then used in all subsequent analyses. Hierarchical model exhibited an acceptable fit: $\chi^2(49) = 88.095$, $p = .001$, CFI = .978, CFI = .970, RMSEA = 0.069, 90% CI: [0.045, 0.091], SRMR = 0.032. Composite reliability was excellent (α =.96).

COVID-19 Preventive Behavior

COVID-19 related preventive behavior was measured using an 11-item scale that was developed for this study and was based largely on the recommendations of CDC (2020). Each item described a prevention guideline (e.g., *Wearing a face mask in indoor public spaces*, see Appendix B in online supplemental materials) and participants were asked to indicate the extent to which they followed it on a 5-point scale. (*I did not follow the guideline at all*) to 5 (*I followed the guideline completely*). A one-factor solution was suggested by EFA, however, item 9 had to be omitted due to its low loading. The model was then estimated by CFA. As the proposed model showed a poor fit, item 7 was exluded due to its high residual covariances and additional residual covariance was allowed. The modified model exhibited good fit: $\chi^2(26) = 42.407$, $p < .001$, CFI = .975, CFI = .965, RMSEA = 0.058, 90% CI: [0.022, 0.088], SRMR = 0.040. Internal consistency of the shorter version of the scale was very good (α = .87).

COVID-19 Vaccination Intentions

COVID-19 vaccination intentions were measured with a single item (*I would get vaccinated against COVID-19*). Participants were asked to rate how likely they would engage in the described type of behavior. The answers were given on a 7-point scale with anchors, 1 (*Not at all likely*) and 7 (*Extremely likely*).

Willingness to Share Opinions about the New Coronavirus

To measure willingness to share opinions about the new coronavirus we constructed a 6-item scale, which included descriptions of different types of actions that can be taken to spread one's beliefs about the new coronavirus, ranging from anonymous online activity to attending public riots (e.g., *I would share my beliefs about the new coronavirus on social networks*, see Appendix C in online supplemental materials). Participants were

asked to rate the likelihood of their engagement in the described behaviors on a 7-point scale with anchors, 1 (*Not at all likely*) and 7 (*Extremely likely*). EFA suggested one-factor structure, however item 1 was omitted due to its low semantic differentiation from item 5. During the CFA, additional residual covariance was allowed to achieve a good fit: $\chi^2(4) = 2.707$, $p < .001$, CFI = 1.000, CFI = 1.000, RMSEA = 0.000, 90% CI: [0.000, 0.082], SRMR = 0.016. Internal consistency of the modified 5-item scale was acceptable ($\alpha = .77$).

Results

Analytical Strategy

All statistical analyses were performed in RStudio (Rstudio Team, 2016), using packages psych (Revelle, 2018) and lavaan (Rosseel, 2012). Dataset and R-code are available in OSF online repository (Dataset, 2021).

First, the sample was randomly split in half, allowing underlying structure of newly developed measures to be identified by exploratory factor analysis (EFA) and additionally assessed by confirmatory factor analysis (CFA). As the data were non-normally distributed, an ordinary least square factoring method was used in EFA and the robust maximum likelihood method (MLM) was used for model estimations in CFA. In addition to the χ^2 test, the goodness of fit was also estimated by incremental fit indices CFI and TLI (>.90), parsimonious fit index RMSEA (<.06) and absolute fit index SRMR (<.08). Some scales had to be modified to achieve an acceptable fit (see Preliminary analyses document in online supplemental materials). Next, Kendall correlations were calculated between all measured variables and tested for statistical significance. Since we aimed to examine the relationships between several latent variables, we used structural equation modelling (SEM) which accounts for measurement error when working with latent constructs. Several different models have been examined. Model I included COVID-19 conspiracy beliefs as a predictor, COVID-19 preventive behavior, vaccination intentions and willingness to share opinions about the new coronavirus as criterion factors and sociodemographic variables as controls. Model II was based on Model I with added trust in science and perceived dangerousness of the new coronavirus as mediating variables between COVID-19 conspiracy beliefs and health-related outcomes. Model III included sociodemographic variables as predictors, COVID-19 conspiracy beliefs as a mediator and health-related outcomes as criterions. The fit of the proposed structural models was also estimated by MLM, and all aforementioned fit indices were examined. Next, regression coefficients and coefficients of determination were inspected. In Models II and III indirect effects were also estimated as calculated products of regression coefficients. For reasons of clarity only structural parts of the models are presented in the results section, however, data on measurement models can be found in online supplemental materials.

Descriptive Statistics and Correlations between the Used Variables

Descriptive statistics and correlations between all measured constructs are shown in Table 1. Since data distributions significantly differed from normal, medians and interquartile ranges are reported as well as Kendall's Tau correlation coefficients.

COVID-19 conspiracy beliefs were positively correlated with age, religiosity and share of COVID-19 information obtained on social media while being negatively correlated with male gender and total years of formal education. On the other hand, COVID-19 conspiracy

Table 1 *Descriptive statistics and intercorrelations (n = 489)*

	Mdn	*IQR*	1	2	3	4	5	6	7	8	9	10
1. Covid-19 conspiracy beliefs	6.13	8.75	—									
2. Age	34.00	22.00	.09**	—								
3. Gender (0 – female, 1 – male)			-.15***	-.01	—							
4. Total years of education	15.00	4.00	-.22***	-.05	.01	—						
5. Religiosity	2.00	3.00	.13***	-.03	-.13***	-.10**	—					
6. Information from social media	50.00	50.00	.29***	.01	-.22***	-.15***	.16***	—				
7. Trust in science	3.45	1.30	-.59***	-.11***	.18***	.22***	-.14***	-.25***	—			
8. Perceived dangerousness	5.00	4.00	-.40***	.08*	.08*	.05	.05	-.08*	.33***	—		
9. Preventive behavior	4.69	0.99	-.27***	.17***	-.06	.06	.05	-.09**	.21***	.44***	—	
10. Vaccination intentions	4.00	6.00	-.53***	.06	.15***	.19***	-.07	-.23***	.47***	.51***	.32***	—
11. Willingness to share opinions	2.88	2.16	.09**	.08*	.02	.00	-.07	.04	-.07*	-.02	-.06	.00

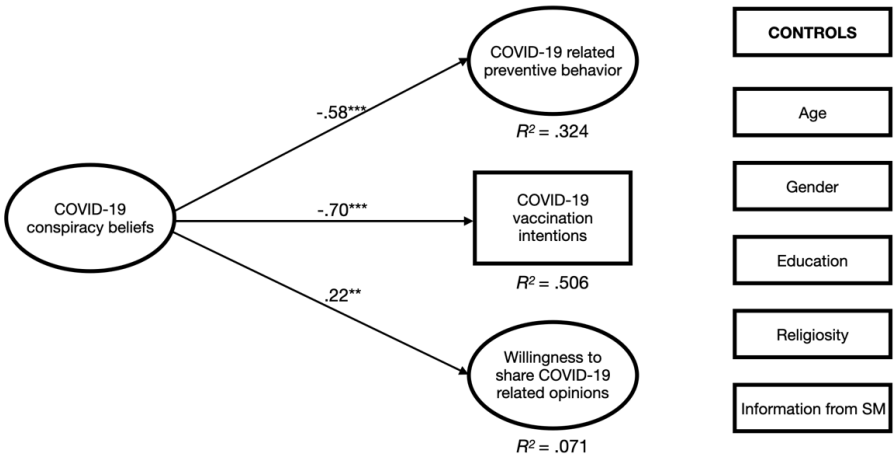
Note. *$p < .05$. **$p < .01$. ***$p < .001$.

beliefs were negatively correlated with preventive behavior and vaccination intentions, and positively correlated with willingness to share opinions about the coronavirus. A negative relationship was also observed between COVID-19 conspiracy beliefs and both trust in science and the perceived dangerousness of the coronavirus. Furthermore, trust in science and perceived dangerousness of the coronavirus were both positively correlated with preventive behavior as well as vaccination intentions, while only trust in science was significantly negatively correlated with willingness to share opinions about the coronavirus.

SEM Analyses

Firstly, we wanted to determine whether COVID-19 conspiracy beliefs are a statistically significant predictor of different health-related outcomes and how much variance they can explain. In the initial phase, Model I was estimated without the inclusion of sociodemographic control variables (see Figure S1 in online supplemental materials). As fit indices suggested an acceptable model fit ($\chi^2(311) = 803.194$, $p < .001$, CFI = .931, TLI = .922, AIC = 49360.380, BIC = 49641.405, RMSEA = .062, 90% CI: [.056, .067], SRMR = .086) regression coefficients were examined. The results indicated that COVID-19 conspiracy beliefs were a statistically significant predictor of all three health-related outcomes, explaining approximately 46% of variance in vaccination intentions ($\beta = -.68$, $p < .001$), 21% of variance in preventive behavior ($\beta = -.46$, $p < .001$), and 3% of variance in willingness to share opinions about the new coronavirus ($\beta = .17$, $p = .008$).

Model fit was acceptable even after sociodemographic variables were introduced ($\chi^2(426) = 1082.620$, $p < .001$, CFI = .916, TLI = .902, AIC = 57735.755, BIC = 58163.376, RMSEA = .060, 90% CI: [.055, .064], SRMR = .077) and all regression coefficients remained significant, which can be seen in Figure 1.



Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

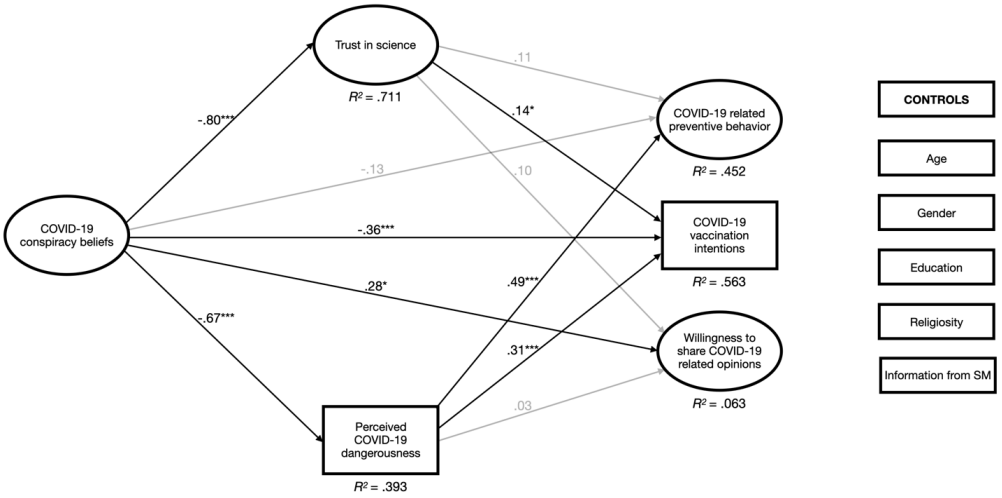
Figure 1 Specified structural Model I with calculated standardized regression coefficients and coefficients of determination (n = 489).

Secondly, we tested the hypothesis that trust in science and perceived dangerousness of the new coronavirus can be defined as mediating variables in the relationship between COVID-19 conspiracy beliefs and health-related outcomes. Specified Model II, presented in Figure 2, had an acceptable fit: $\chi^2(1266) = 2569.117$, $p < .001$, CFI = .910, TLI = .902, AIC = 83529.273, BIC = 84221.012, RMSEA = .049, 90% CI: [.046, .052], SRMR = .066.

The results showed that the perceived dangerousness of the coronavirus completely mediated the relationship between COVID-19 conspiracy beliefs and preventive behavior (indirect effect: $\beta = -.33$, $p < .001$), partially mediated the relationship between COVID-19 conspiracy beliefs and vaccination intentions (indirect effect: $\beta = -.21$, $p < .001$) and did not predict willingness to share opinions about the coronavirus. On the other hand, trust in science only partially mediated the relationship between COVID-19 conspiracy beliefs and vaccination intentions (indirect effect: $\beta = -.12$, $p = .041$) and did not predict either preventive behavior or willingness to share opinions.

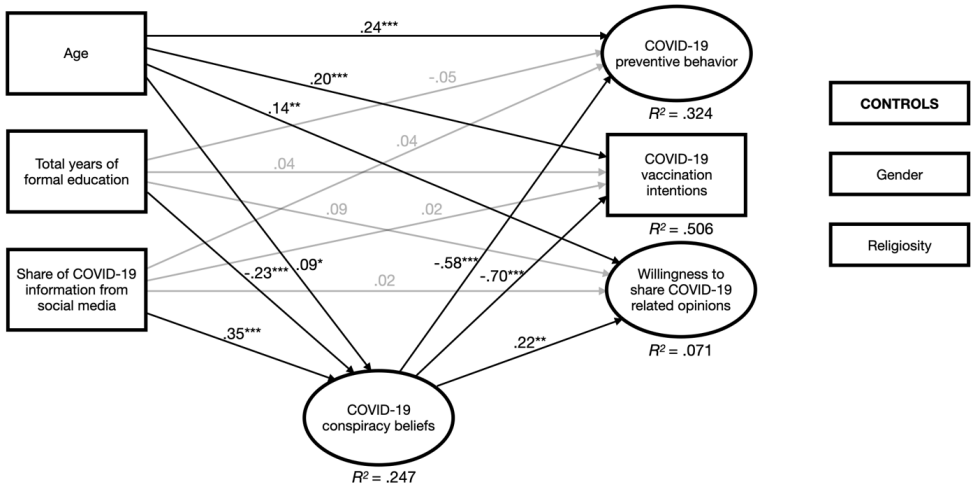
Thirdly, we aimed to explore the relationships between sociodemographic variables and COVID-19 conspiracy beliefs and examine the potential role of COVID-19 conspiracy beliefs as a mediator between sociodemographics and health-related outcomes. Fit of Model III (see Figure 3) was acceptable: $\chi^2(426) = 1082.622$, $p < .001$, CFI = .916, TLI = .902, AIC = 57735.755, BIC = 58163.376, RMSEA = .060, 90% CI: [.055, .064], SRMR = .077.

Age, gender, total years of formal education, religiosity and the share of COVID-19 information obtained on social media together explained approximately 25% of variance in COVID-19 conspiracy beliefs, however, only age, years of education and share of information from social media were statistically significant predictors. Subsequent mediation analysis (see Table 2) showed that COVID-19 conspiracy beliefs completely mediated the



Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Figure 2 Specified structural Model II with calculated standardized regression coefficients and coefficients of determination (*n* = 489).



Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Figure 3 Specified structural Model III with calculated standardized regression coefficients and coefficients of determination (*n* = 489).

Table 2 *Results of mediation analysis in Model III*

Indirect effect path	Estimate	*S.E.*	*p*	*β*
Age -> conspiracy beliefs -> preventive behavior	-0.065	0.029	.026	-.054
Age -> conspiracy beliefs -> vaccination intentions	-0.093	0.042	.026	-.065
Age -> conspiracy beliefs -> willingness to share opinions	0.021	0.012	.070	.020
Education -> conspiracy beliefs -> preventive behavior	0.158	0.038	<.001	.130
Education -> conspiracy beliefs -> vaccination intentions	0.224	0.053	<.001	.157
Education -> conspiracy beliefs -> willingness to share opinions	-0.051	0.021	.015	-.049
SM information -> conspiracy beliefs -> preventive behavior	-0.246	0.044	<.001	-.202
SM information -> conspiracy beliefs -> vaccination intentions	-0.349	0.055	<.001	-.245
SM information -> conspiracy beliefs -> willingness to share opinions	0.079	0.029	.007	.076

relationships between total years of education and all three health-related outcomes as well as the relationships between share of COVID-19 information from social media and all three health-related outcomes. Conspiracy beliefs also partially mediated the relationship between age on one hand and preventive behavior and vaccination intentions on the other, while an indirect effect of age on willingness to share opinions through COVID-19 conspiracy beliefs was not statistically significant.

Discussion

The primary aim of our study was to examine the role of COVID-19 conspiracy beliefs in predicting outcomes that could potentially worsen the course of the pandemic: preventive behavior, vaccination intentions and willingness to share COVID-19 related opinions. In line with our hypotheses and some previous research (e.g., Bertin et. al, 2020; Freeman et al., 2020), the results showed that COVID-19 conspiracy beliefs were a statistically significant predictor of preventive behavior (H1), vaccination intentions (H2) and willingness to share opinions about the new coronavirus (H3). Outcomes remained unchanged even after sociodemographic variables and share of COVID-19 information participants obtained on social media were controlled for, which further reinforces some of the previous uncontrolled correlational findings about the potential detrimental effects of COVID-19 conspiracy beliefs.

Even though many COVID-19 conspiracy beliefs contain specific elements that emphasize adverse consequences of certain preventive measures (e.g., wearing masks causes harm due to the lack of oxygen) or vaccination (e.g., vaccination has unreported dangerous side effects), previous research has indicated that it may not be the inherent fearful characteristics of such measures that are making them more prone to be rejected by those with high conspiracy mentality. As demonstrated by Marinthe et al. (2020), support for preventive measures by those with strong conspiracy beliefs depends on the subject that is making the recommendation to comply, i.e. preventive behavior is more likely to be rejected in the case of government endorsement. As those with high conspiracy mentality can attribute evil agendas to people in power (van Prooijen & Douglas, 2017), this might lead

to rejection of their instructions. Therefore, it is important to note, that the preventive behavior scale used in our study included only behaviors that were recommended by health organizations and were consequently introduced in the form of various government suggestions and ordinances. Inclusion of other items that may not be so closely related to the recommendations of authorities may therefore result in different outcomes.

Furthermore, conspiracy beliefs might predict willingness to share opinions about the new coronavirus due to the perceived superior position of believers, which stems from supposed possession of hidden knowledge, and may also manifest itself as prophetic transmission of conspiracies (Franks et al., 2017). Sharing conspiracy theories may also be a way to establish social contacts with like-minded people or strengthen the position in the group of other believers (Franks et al., 2017). However, conspiracy beliefs explained only around 3% of variance in willingness to share opinions about the coronavirus, which was lower than expected and may suggest caution in further research.

The second aim of our study was to examine whether perceived dangerousness of the coronavirus and trust in science mediate the relationships between conspiracy beliefs and health-related outcomes. Consistent with our expectations and some previous findings (e.g., Chayinska et al., 2020; Romer & Jamieson, 2020) perceived dangerousness of the coronavirus completely mediated the relationship between conspiracy beliefs and preventive behavior (H4a) and partially mediated the relationship between conspiracy beliefs and vaccination intentions (H5a). The results therefore suggest that COVID-19 conspiracy beliefs may pose a risk to public health especially by lowering danger perceptions of the new coronavirus, however, the correlational design of our study does not allow us to draw more definite causal conclusions. Since only general risk assessments of the new coronavirus were measured in our study, we would also like to note that it might be important to differentiate between personal and public risk perceptions, as some authors report on their distinct roles in predicting preventive behavior, which may as well vary between different cultures (Chayinska et al., 2020). Some of the previous research (Chan et al., 2021; Imhoff & Lamberty, 2020) has also indicated that risk perceptions may depend on the type of supported conspiracy beliefs. For example, those who believed that the coronavirus was artificially created as a bioweapon exhibited higher risk perceptions, while those who believed the pandemic was a hoax perceived little or no risk (Chan et al., 2021). Interestingly, in our research we were not able to identify this difference although our COVID-19 conspiracy beliefs scale included both kinds of statements. Our results showed that all items were negatively correlated with risk perceptions, as even the participants who endorsed the direct statement that the new coronavirus was developed as a bioweapon felt less threatened by the new coronavirus (ρ = -.29, p < .001).

Conversely, our hypothesis about the mediating role of trust in science in the relationship between conspiracy beliefs and preventive behavior (H4b) was rejected, showing discrepancy with the findings of Plohl & Musil (2020), who reported on conspiracy mentality predicting compliance with preventive guidelines only through trust in science and not through the perceived COVID-19 risk. The described inconsistencies may be partially explained by the differences in predictor variables, as general conspiracy mentality and COVID-19 conspiracy beliefs should only be considered as highly correlated but not completely overlapping constructs (e.g., Georgiou et al., 2020). Furthermore, Plohl & Musil

(2020) used a different measure of COVID-19 risk perception that combined both personal and public risk perceptions, whereas only general risk perceptions were measured in our study. Their research was also conducted in different socio-cultural environment and at a different time point in the course of the pandemic, which could influence the extent to which scientists were considered entangled in the pandemic.

In the case of vaccination intentions trust in science played a partial mediating role (H5b), however, estimated indirect effects were almost non-significant. As the correlation between trust in science and perceived dangerousness of the coronavirus was moderate, the results might therefore suggest that due to the relatedness of the constructs, trust in science explains little additional variance in health-related behavior when perceived dangerousness of the coronavirus is controlled for.

The third objective of our research was to identify the risk factors for the occurrence of COVID-19 conspiracy beliefs. As Slovenia is among the European countries with the lowest vaccination rates and highest number of deaths per million people due to COVID-19 (Ritchie et al., 2021, September, 27), we aimed to provide a scientific base for accurately addressing the spread of conspiracy beliefs and potentially alleviating some of their adverse consequences. In contrast to prior research (e.g., Romer & Jamieson, 2020), correlation analysis showed that older individuals are more likely to believe in COVID-19 conspiracy theories, which could possibly be due to their lower social media literacy. As most of our older participants were recruited on social networks, which are known for weak restrictions on shared content, lack of understanding how the social media work could lead to uncritical consumption of misinformation, thus resulting in greater conspiracy beliefs. Similarly as Alper et al. (2020), we also found that females are more prone to COVID-19 conspiracy beliefs compared to males. This could indicate that women in Slovenia experience more powerlessness than men, which is not surprising given the fact that preexisting gender inequalities were amplified during the pandemic (Raile et al., 2020). In line with previous research (e.g., Georgiou et al., 2020), COVID-19 conspiracy beliefs were also less pronounced in individuals with higher education, possibly due to a more developed ability to think analytically (Swami et al., 2014). The results also showed that those who are more religious exhibit stronger COVID-19 conspiracy beliefs, which coincides with prior findings, as several shared traits of conspiracy and religious beliefs have been previously identified (Alper et al., 2020; Dyrendal, 2020). Regarding the share of information obtained on social media, results were also in line with our theoretical foundations and some previous findings (e.g., Freeman et al., 2020), indicating that those who rely on social media as an important source of information show higher endorsement of COVID-19 conspiracy theories.

Further analysis showed that all above-mentioned variables together explained about one-quarter of the variance in COVID-19 conspiracy beliefs, however, only share of obtained information, years of formal education and age were identified as significant predictors. Proceeding from this finding, the mediating role of conspiracy beliefs in the relationships between these three variables and health-related outcomes was investigated. The results showed that COVID-19 conspiracy beliefs at least partially mediated all examined relationships except the one between age and willingness to share opinions, highlighting the importance of accurately addressing the proliferation of those beliefs in order to change societal behavior to be more

in line with scientific guidelines for controlling the course of the pandemic.

Although our research successfully builds on previous partial findings and provides some valuable insights into complex relationships between sociodemographics, conspiracy beliefs and behavioral outcomes, some limitations of our study must be considered. Firstly, a convenience sample was used, which may not be entirely representative of the population. Secondly, most of the used scales were newly developed, so their metric characteristics are to be taken with caution. And thirdly, our study was correlational, so all causal inferences are only speculative. It is also important to note that findings might be influenced by the specific time point of measurement and the epidemiological situation in the targeted country.

Therefore, we believe that future research should mainly focus on conducting randomly sampled longitudinal studies, which could enable us to draw more definite causal conclusions. Researchers of conspiracy beliefs in the context of COVID-19 pandemic could also benefit from the development of standardized scales, which would provide more reliable and valid estimates of measured constructs, thus also enabling better comparisons between different cultural environments. Proceeding from findings about the risk factors for conspiracy beliefs, interventions to reduce their endorsement should be developed and their efficacy should be empirically examined. In our opinion, a possibility of bidirectional relationships between COVID-19 conspiracy beliefs and health-related behaviors should also be considered, as altering the behavior may result in reduction of conspiracy beliefs due to the induced dissonance.

Conclusions

In order to successfully manage the COVID-19 pandemic it is crucial to encourage people to comply with preventive measures and even more importantly to convince them to get vaccinated. The results of our study suggest that COVID-19 conspiracy beliefs may be an important hindrance to achieving these goals, as they were identified as an important predictor of preventive behavior and vaccination intentions as well as willingness to share opinions about the coronavirus, which might indirectly influence health-related behavior by encouraging others to adopt conspiracy beliefs. Additionally, perceived coronavirus threat has been identified as a potential mediating factor between conspiracy beliefs and health-related outcomes. The results also indicate some risk factors for the occurrence of conspiracy beliefs, which should be considered when establishing communication strategies for raising awareness about the necessary COVID-19 measures. According to our findings it would be expedient to invest more effort in targeting people who are less educated and those who use their social media as an important source of information as well as promoting social media literacy of the elderly.

To conclude, our research has contributed to the emerging knowledge about conspiracy theories in the context of the COVID-19 pandemic and highlighted the importance of successfully dealing with them when trying to induce certain types of behavior and preserve public health.

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