

# Coronavirus conspiracy beliefs and distrust of science predict risky public health behaviours through optimistically biased risk perceptions in Ukraine, Turkey, and Germany

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## Abstract

The present paper examines the extent to which conspiracy beliefs about the COVID-19 outbreak and distrust of epidemiological science are likely to predict optimistically biased risk perceptions at the individual and group levels. We explored the factor structure of coronavirus conspiracy beliefs and their associations with trust in science in predicting risk perceptions using survey data collected in Ukraine ( $N = 390$ ), Turkey ( $N = 290$ ), and Germany ( $N = 408$ ). We further expected conspiracy beliefs and distrust of science to predict people's willingness to attend public gatherings versus maintaining preventive physical distancing through optimistically biased risk perceptions. Metric noninvariance for key constructs across the samples was observed so the samples were analysed separately. In Ukraine, a two-factor structure of conspiracy beliefs was found wherein COVID-19 bioweapon (but not COVID-19 profit) beliefs were negatively associated with public gathering through optimistically biased individual risk perceptions. In Turkey and Germany, conspiracy beliefs showed a single-factor solution that was negatively associated with preventive distancing and positively related to public gathering through optimistically biased public risk metaperceptions. The hypothesis about the direct and indirect effects of trust in science on risky health behaviour was partially confirmed in all three samples. The observed discrepancies in our findings are discussed.

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## Keywords

conspiracy beliefs, coronavirus, pandemic, preventive physical distancing, risk perceptions, risky health behaviour, trust in science

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Although international official health organizations have established the COVID-19 pandemic to be an objective risk to public health (e.g., World Health Organization [WHO], 2020), many people across societies have deliberately neglected precautions and protective behaviours (e.g., Dryhurst et al., 2020; Moritsugu, 2020). One reason why people may opt for drastically different personal approaches to public health behaviours in the context of the pandemic is arguably their risk perceptions, that is, their subjective probabilistic appraisals of risk posed by the coronavirus (e.g., Dryhurst et al., 2020; Ferrer & Klein, 2015). For instance, a large survey study conducted in Europe in the early stage of the COVID-19 pandemic revealed an optimistic bias, meaning that the majority of respondents were likely to have overly optimistic views about the severity of the newly discovered disease as well as about their chances of getting infected (e.g., Raude et al., 2020).

Meta-analytic evidence has suggested that optimistically biased risk perceptions, defined as underestimated probabilistic assessments of certain events, are a critical determinant of risky health behaviour (e.g., Brewer et al., 2007; Epton et al., 2015). This kind of misperception has been found to be associated with the spread of contagious diseases at the community level (e.g., Abdulkareem et al., 2020; Ferrer & Klein, 2015; Williams et al., 2010). Therefore, the current contribution is designed to systematically address the phenomenon of the optimistic bias in risk perceptions at both individual and group levels, by focusing on their psychological antecedents and consequences in the context of the COVID-19 pandemic. Importantly, we seek to link the psychological processes associated with optimistically biased risk perceptions to the understanding of the relevant individual and collective behavioural health responses to the global emergent

pandemic faced by all of humanity. Confronting the transmission of a fast-moving pandemic appears to present a collective action problem that can seemingly be solved by group efforts, joint diversified strategies, and local community-driven solutions (e.g., Davenport et al., 2020; Thomas et al., 2012). That is, just as it is true that solving the challenge of COVID-19 requires top-down regulation, it is also the case that changing problematic behaviour of individuals (i.e., non-compliance with the locally imposed prevention and mitigation measures) involves incremental and deliberate bottom-up efforts that are amenable to social psychological analysis.

Extensive empirical research has revealed that biased cognitive processes in the health domain, including risk misperceptions, can be a product of individuals' belief in conspiracy theories, that is, explanatory beliefs about some entity's intentional harmful actions towards achieving concealed corrupt goals (e.g., Bogart et al., 2010; Brotherton et al., 2013; Jolley & Douglas, 2014). A signature feature of conspiracist beliefs and biased risk perceptions in the public health domain is distrust of scientific experts, which often implies doubts about the independence of researchers and the scientific system from large corporations (often, but not only, pharmaceutical companies) as well as governments (e.g., Bedford et al., 2019; Dixon & Jones, 2015; Lamberty & Imhoff, 2018; Wood et al., 2012).

According to van Prooijen and Douglas (2017), crises such as large-scale public health emergencies can undermine the public's trust in government regulations. Such crises may stimulate individuals' increased efforts to make sense of highly uncertain situations. Unsurprisingly, the COVID-19 outbreak has marked a new era of global conspiracy-laden rhetoric about the newly discovered infection (e.g., Bates, 2020; Destiny,

2020). In the US, for example, mainstream news media services such as CNN, FOX News, and *The Washington Times* have widely reported commentary and speculation, including from senior government officials, that the coronavirus was artificially created in a lab and deliberately released as a biological weapon (e.g., Fisher, 2020; Palmer, 2020; Sardarizadeh & Robinson, 2020). At the same time, Russian and Chinese state media have circulated commentaries that COVID-19 was allegedly an American biological weapon brought to China, and that the US should be held accountable for the global pandemic (e.g., Fisher, 2020; Palmer, 2020; Sardarizadeh & Robinson, 2020). The prevalence of coronavirus conspiracy theories in public discourse can arguably explain the alarming percentage of people within societies endorsing them. A nationally representative survey by the Pew Research Center conducted in March 2020 showed that 23% of U.S. citizens believed that the novel coronavirus was most likely developed intentionally in a lab, and 6% believed it was most likely made accidentally in a lab (Romano, 2020). Another nationally representative survey conducted by Carleton University in Canada revealed that 46% of Canadian citizens believed at least one of four COVID-19 conspiracy theories and myths (e.g., the SARS-CoV-2 virus is a Chinese-engineered bioweapon released from a lab) addressed in the survey (Raymond, 2020). People's exposure to multiple and contested information about the COVID-19, including claims of a lack of scientific consensus on the vaccine against the virus (e.g., Gallagher, 2020; Picheta, 2020; Reuters, 2020a), may arguably add to the declining trust in epidemiological science as a system of knowledge as well as public health practitioners such as virologists and epidemiologists. Therefore, although previous research has generally approached beliefs in conspiracy and distrust of science as rather stable cognitive and attitudinal phenomena (e.g., Brotherton et al., 2013; van der Linden et al., 2020), there are grounds to argue that the prevalence of conspiracy beliefs about the origin of the SARS-CoV-2 virus and the observed distrust of epidemiological science may be understood as situational

psychological responses to the crisis posed by the pandemic.

Integrating ideas from previous research, in this contribution, we thus sought to provide a systematic test of the notion that in the context of the COVID-19 outbreak, specific, content-laden conspiracy theories could be highly inter-related and, thus, represent a general mindset of conspiracy mentality (e.g., Freeman et al., 2020; Imhoff & Lamberty, 2020) linked to distrust of science and indirectly associated with risky health behaviour through two distinct psychological constructs pertaining to optimistically biased risk appraisals: (a) individual risk perceptions, that is, one's appraisals of their chance of becoming infected with COVID-19, and (b) public risk metaperceptions, that is, individuals' perception that others view the severity of the coronavirus to be overly exaggerated. We examined these hypotheses in three different national contexts within Europe: Ukraine, Turkey, and Germany.

### **The Role of Conspiracy Theory Beliefs and Distrust of Science in Risk Perceptions**

A considerable body of empirical research has highlighted that individuals' risk perceptions have a significant impact on their behavioural responses to infectious disease outbreaks (e.g., Ferrer & Klein, 2015; Williams et al., 2010). Risk appraisals are often based on individuals' domain-specific direct personal experiences (e.g., Ferrer & Klein, 2015; van der Linden, 2014) and generally consist of people's estimates of their personal chance of contracting an infection, including estimates of the severity of a disease (e.g., Seeger et al., 2018; Smith, 2006). Empirical evidence has demonstrated that individuals who are excessively optimistic in their evaluation of health risks tend to minimize the severity of the perceived threat and are subsequently less inclined to engage in precautions and protective behaviours (e.g., Dillard et al., 2009; Radcliffe & Klein, 2002; Shepperd et al., 2013; Taylor et al., 1992). Critically, the formation of individual-level risk perceptions in the public health domain

is associated with (and was shown to be influenced by) metaperceptions, that is, the perception of the general public's estimates of whether a hazardous event will occur (e.g., Dillard et al., 2009; Shepperd et al., 2013). Further, the formation of individual risk perceptions can be conditioned by the salient information about a disease people are exposed to (e.g., Reyna et al., 2009; Wahlberg & Sjöberg, 2000).

Public risk reactions to infectious disease outbreaks, including the COVID-19, are sensitive to conspiracy-laden narratives about their origins (e.g., van Bavel et al., 2020). It has been empirically established that individuals' tendency to believe in conspiracy theories about emerging infectious diseases can crucially determine their risk perceptions and reluctance to engage in precautions and protective behaviour (e.g., Fourie & Meyer, 2010; Freeman et al., 2020; Imhoff & Lamberty, 2020). For instance, in the context of the Ebola epidemic in 2014, people who believed that this virus had been manufactured in a lab as an experiment to control the population in African countries were less likely to engage in precautionary behaviours and voluntary isolation (e.g., Earnshaw et al., 2019). The belief in Ebola conspiracy theories was thus found to be related to reluctance to support the development and implementation of a variety of interventions to prevent epidemic expansion, including vaccination campaigns (e.g., Earnshaw et al., 2019).

Some scholars have suggested that conspiracy thinking associated with risky behavioural intentions represents a unidimensional construct (i.e., a generalized conspiracy world view; e.g., Jolley & Douglas, 2014; Swami et al., 2011; Wood et al., 2012); Imhoff and Lamberty (2020) have shown that, in the context of the COVID-19 outbreak, theories claiming that the pandemic is a hoax versus those claiming that the coronavirus is a human-made bioweapon were distinguished empirically as highly positively correlated constructs, associated with a general mindset of conspiracy mentality. The authors also found that believing the COVID-19 is a hoax (vs. a bioweapon) was related to less compliance with infection-reducing measures.

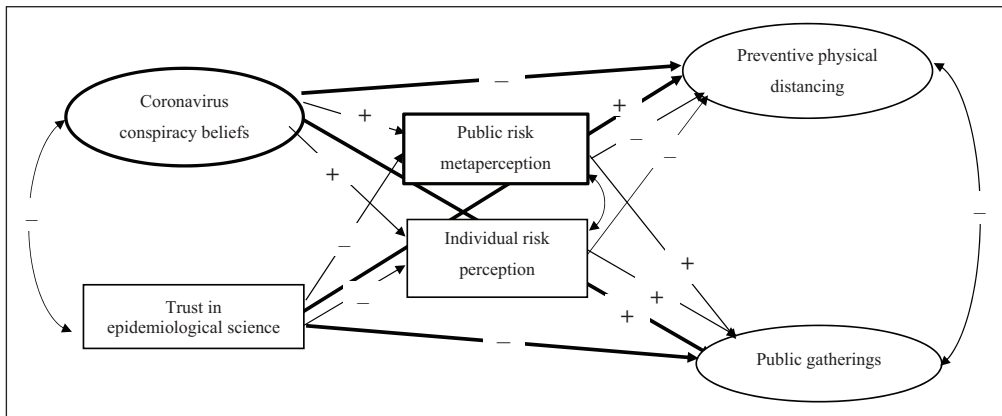
A crucial correlate of beliefs in health conspiracy theories is their distrust of science as a system of knowledge (e.g., Brotherton et al., 2013; Lamberty & Imhoff, 2018; Lewandowski et al., 2013). Distrust of science often implies the suspicion of and lack of confidence in the independence of researchers from large corporations and governments (e.g., Brotherton et al., 2013; Lamberty & Imhoff, 2018; Oliver & Wood, 2014; van der Linden, 2015). Some studies have found that people who hold conspiracist beliefs and distrust science have lower motivation to engage in public health behaviours (e.g., Dale et al., 2016; Kalichman et al., 2017).

Summing up, although previous research in social and public health psychology has linked conspiracy thinking and distrust of science to people's noncompliance with prevention and mitigation measures in the context of infectious disease emergencies, we raise the question about the extent to which these direct paths are mediated by two different yet interrelated optimistically biased risk perceptions: (a) individual risk perceptions, and (b) public risk metaperceptions. Both types of risk misperceptions are generally targeted in health behaviour change interventions. Therefore, by examining the antecedents of such optimistic estimates, our research seeks to produce knowledge needed for designing incentives and effective communication strategies aimed at mitigating the risk at the individual and group levels.

## The Present Research

Integrating ideas from previous studies, in this research, we expected to replicate the established findings that specific content-laden conspiracy beliefs about some nefarious intent behind the COVID-19 outbreak could be distinguished empirically as a unidimensional construct (i.e., general conspiracy mindset; e.g., Jolley & Douglas, 2014; Swami et al., 2011; Wood et al., 2012), highly correlated with distrust of science (Lewandowski et al., 2013; van der Linden, 2015), and predictive of individuals' intentions to engage in preventive physical distancing as opposed to their willingness to follow official recommendations to avoid mass

**Figure 1.** Theoretical model predicting intentions to engage in preventive physical distancing and public gatherings through coronavirus conspiracy beliefs and trust in science, mediated by optimistically-biased risk perceptions at the individual and group levels.



*Note.* The hypothesized direct paths are depicted in bold.

public gatherings (Freeman et al., 2020; Imhoff & Lamberty, 2020) amid the imposed lockdown. We thus focused on individuals' behavioural intentions, as they are considered to be a reliable and useful proxy for actual behaviour (for a meta-analysis, see Webb & Sheeran, 2006). Critically, we proposed that embracing coronavirus conspiracy theories and distrusting epidemiological scientific experts in combating the pandemic would predict behavioural intentions in the public health domain both directly and indirectly through (a) denying one's own risk of getting infected, and (b) perceiving others as exaggerating the pandemic's severity. The two proposed mediators pertain to optimistically biased risk perceptions, a crucial psychological construct operating at both individual and group levels, which have been previously associated with people's noncompliance with prevention and mitigation measures in the context of public health emergencies (e.g., Dryhurst et al., 2020; Ferrer & Klein, 2015; Williams et al., 2010).

Because most of the studies mentioned in the introduction relied on data from "WEIRD" populations (i.e., Western, educated, industrialized, rich, and democratic; see Henrich et al., 2010) within either the US or Western Europe, the current research aimed to check whether the same

psychological processes can be identified outside those countries as well. We therefore examined these hypotheses in three different national contexts within Europe—Ukraine, Turkey, and Germany—two of which (Ukraine and Turkey) have been underrepresented in mainstream social psychological research. The proposed theoretical model is depicted in Figure 1.

Finally, based on discussions from previous research (e.g., Ferrer & Klein, 2015; Williams et al., 2010), we also tested an alternative (sequential mediation) model in which we examined the notion that conspiracy thinking and distrust of science predict optimistically biased public risk metaperceptions, which in turn positively predict optimistic individual risk perceptions, thus predicting more willingness to adopt risky health behaviour in the context of emergent infectious diseases (see Figure S1 in the online supplemental material).

### Research Context: The COVID-19 Pandemic in Ukraine, Turkey, and Germany

We tested the applicability of our theoretical model and, in particular, explored the underlying dimensionality of the construct of coronavirus

conspiracy beliefs in three different European contexts from the WEIRD perspective: non-WEIRD Ukraine and Turkey as well as WEIRD Germany. At the time of data collection, the three countries had a relatively similar standing in their exposure to the pandemic spread in terms of their registered COVID-19 fatality rates per one million population (Worldometer, 2020).

In Ukraine, a state of emergency was declared on March 20, 2020 by the national government, the week after the first COVID-19 fatality was registered (Ministry of Healthcare of Ukraine, 2020). The nationwide temporary restrictive measures included the closure of all educational facilities; city subway systems; limitations on passenger transportation and mass gatherings; and temporary closure of religious, cultural, and entertainment establishments (Reuters, 2020b). In Turkey, state-level restrictive measures were introduced on March 16, 2020, a day after the first COVID-19 fatality was registered (Anadolu Agency, 2020). In Germany, the first coronavirus fatality case was confirmed on March 9, 2020. The German Parliament passed two coronavirus containment laws on March 25, 2020, but a state-level emergency was not declared (Bundesministerium für Gesundheit, 2020). Similarly to Ukraine, in both Turkey and Germany, a set of similar lockdown measures had been introduced: public events (e.g., conferences, exhibitions) were cancelled; places of social gathering, including schools and universities, were closed; the recommendation to maintain a 2-meter distance and to wear face mask was officially issued (e.g., Anadolu Agency, 2020; Bundesministerium für Gesundheit, 2020).

According to the national poll conducted in Ukraine in May–June 2020, 66% of respondents considered the coronavirus to have an artificial origin (Kyiv International Institute of Sociology [KIIS], 2020). Conspiracy theories surrounding the emergence of the COVID-19 had been, reportedly, increasingly discussed in mainstream Turkish and German media (e.g., Bakeer, 2020; Nehring, 2020). We therefore found these contexts suitable for testing our theoretical model. In all three countries, efforts were made to recruit a

general population sample diverse in terms of age, educational level, and urban/rural designation.

## Method

### *Research Design and Procedure*

Data collection was conducted between May 26 and June 7, 2020, following ethical approval by Eötvös Loránd University. The questionnaire<sup>1</sup> was originally constructed in English and then translated into Ukrainian, Turkish, and German by the study's bilingual collaborators in each country. Respondents were recruited via convenience sampling on social media (i.e., Facebook and Twitter) by circulating a link to the questionnaire entitled “The impact of the COVID-19 on society.” Participants were told that they were participating in a study examining their beliefs, convictions, and experiences regarding the pandemic caused by the coronavirus. In Turkey and Ukraine, respondents participated voluntarily, whereas in Germany, participants had the chance to win one of two €50.00 “takeaway” vouchers for a restaurant of their choice. Three attention checks were embedded in the survey with the instruction to “mark ‘completely agree’” (Maniaci & Rogge, 2014). All data are available in the supplemental material.

### *Participants*

In Ukraine, a total of 469 participants took part in the survey. Participants who failed at least one of the attention checks ( $n = 19$ ) were excluded from the subsequent analysis. Sixty partial responses were removed belonging to respondents who left the survey before answering all questions related to the current research. The final sample was comprised of 390 participants (70.5% female;  $M_{\text{age}} = 36.19$ ,  $SD_{\text{age}} = 11.34$ ; 89.6% urban residents; 63.3% highly educated; 59.4% employed full time and 11% were university students). Some 67.2% of respondents indicated that they had not been infected with the coronavirus, 31.8% were unsure about it, and 1% indicated that they had been infected with SARS-CoV-2.

In Turkey, a total of 345 participants were recruited to participate in the online survey using the same recruitment methods; no financial incentives for participation were offered. Participants who failed the attention checks ( $n = 10$ ) and those who did not complete the relevant measures ( $n = 45$ ) were not included in the final analysis, resulting in a final sample of  $N = 290$  (60.9% female;  $M_{\text{age}} = 39.16$ ,  $SD_{\text{age}} = 16.0$ ; 83.6% urban residents; 41.3% highly educated; 30.5% employed full time and 31.2% were university students). Some 97.2% of respondents indicated that they had not been infected with the coronavirus, while 2.8% said they were unsure.

In Germany, a total of 426 participants completed the online survey. Eighteen participants failed the attention checks and were therefore excluded from the analyses. The final sample was comprised of 408 participants (66.2% female;  $M_{\text{age}} = 29.8$ ,  $SD_{\text{age}} = 11.1$ ; 60.3% urban residents; 58.3% highly educated; 20.8% employed full time and 50.2% were university students). Some 77.9% of respondents had not been infected with the coronavirus, 20.9% were unsure about it, and 1.2% reported that they had been infected.

### Measures

*Coronavirus conspiracy beliefs.* In Ukraine, eight items adopted from previous research (Freeman et al., 2000; Imhoff & Lamberty, 2020) were used to assess the extent to which participants endorsed diverse conspiracy theories related to the COVID-19 outbreak (1 = *completely disagree*, 5 = *completely agree*). In Turkey and Germany, the scale<sup>2</sup> consisted of seven items. The results of exploratory factor analysis (EFA) conducted using the Ukrainian data revealed a two-factor solution (for factor loadings, see Table 1). The four items that loaded on the first factor explained 51.33% of the variance. The other four items loaded onto the second factor, which explained an additional 14.56% of the variance ( $KMO = .87$ ,  $p < .001$ ). The respective items were averaged to create two composite scales for the conspiracy beliefs claiming that the coronavirus was artificially created as a bioweapon (e.g., “The

coronavirus might be a biological weapon”; four items;  $\alpha = .85$ ) and purposefully manufactured for large-scale political and economic profit (e.g., “The coronavirus was created by Bill Gates to sell more vaccines”; four items;  $\alpha = .76$ ).

The results of EFA conducted using the Turkish and German data suggested a one-factor solution for coronavirus conspiracy beliefs, which explained 70.50% and 53.96% of the total variance in Turkey and Germany, respectively (for item loadings, see Table 2). The internal validity for the seven-item scale was excellent in each of the samples (Turkey:  $\alpha = .93$ ; Germany:  $\alpha = .85$ ).

*Trust in epidemiological science.* A single item adapted from the Trust Barometer (Edelman, 2020) was used to assess the extent to which participants “trusted the recommendations of scientists (e.g., epidemiologists, virologists) regarding slowing down the spread of the coronavirus” in their country (1 = *not at all*, 5 = *very much*).

*Public risk metaperception.* A single item was adapted from Dryhurst et al. (2020) to assess the extent to which participants perceived the coronavirus risks to be exaggerated by other people: “Most people around me are overestimating the coronavirus risks” (1 = *completely disagree*, 5 = *completely agree*).

*Individual risk perception.* A single item was adapted from Dryhurst et al. (2020) to assess the extent to which participants perceived a personal risk to be infected with the coronavirus: “I see no particular risk of being infected with the coronavirus” (1 = *completely disagree*, 5 = *completely agree*).

*Preventive physical distancing.* We asked participants, in case quarantine measures were still recommended by governmental authorities, how willing they would be to adopt preventive physical behaviours (1 = *not at all willing*, 5 = *extremely willing*). Participants were asked to rate four items: “Avoiding meeting up with friends,” “Avoiding shaking hands with people that I normally shake hands with,” “Avoiding gatherings of large groups of people,” and “Restricting visitors to your home.” The scale had acceptable internal

**Table 1.** Factor loadings for EFA of items assessing participants' coronavirus conspiracy beliefs: Ukrainian study.

Items	Factor 1	Factor 2
1. The coronavirus is of unnatural origin, created artificially in the laboratory	.90	
2. The coronavirus was started by an experiment that went out of control	.86	
3. The coronavirus might be a biological weapon	.84	
4. The coronavirus is an agent of genocide produced artificially in a lab	.69	
5. The coronavirus was created by China to destroy the West's economies		.79
6. The coronavirus is a myth deliberately spread to influence societies		.76
7. The coronavirus was created to destroy China's economy		.75
8. The coronavirus was created by Bill Gates to sell more vaccines		.73

Note. EFA = exploratory factor analysis.

**Table 2.** Factor loadings for EFA of items assessing participants' coronavirus conspiracy beliefs: Turkish and German studies.

Items	Factor loadings	
	Turkey	Germany
1. The coronavirus is of unnatural origin, created artificially in the laboratory	.89	.82
2. The coronavirus might be a biological weapon	.89	.70
3. The coronavirus was created to destroy China's economy	.84	.79
4. The coronavirus is a myth deliberately spread to influence societies	.83	.66
5. The coronavirus was created for the purpose of genocide	.82	.79
6. The coronavirus was created by Bill Gates to sell more vaccines	.81	.61
7. The coronavirus was started by an experiment that went out of control	.80	.73

Note. EFA = exploratory factor analysis.

consistency: Ukraine:  $\alpha = .68$ ; Turkey:  $\alpha = .71$ ; Germany:  $\alpha = .82$ .

*Attending public gatherings.* We asked participants, in case quarantine measures were still recommended by governmental authorities, how willing they would be to attend mass public gatherings (1 = *not at all willing*, 5 = *completely willing*): "Attending a mass community gathering that is important to you" and "Attending a public event with many people that is important to you." These items were positively highly correlated in all three samples (Ukraine:  $r = .60$ ; Turkey:  $r = .51$ ; Germany:  $r = .66$ ; all significant at  $p < .001$ ).

## Results

### *Analytic Strategy*

Data analysis comprised four steps. First, using SPSS Version 24, we performed bivariate analysis to

ensure there were no violations of the assumptions (IBM, 2017). Second, we performed EFA for the scale measuring coronavirus conspiracy beliefs to explore its factor structure. Using the package lavaan for R version 3.5. (R Core Team, 2018), we then examined the cross-country comparability of the study's key latent constructs with multiple indicators (conspiracy beliefs and preventive physical distancing) by assessing measurement (configural, metric, and scalar) invariance (Cheung & Rensvold, 2002; Milfont & Fischer, 2010). Third, we used Mplus Version 7.4 (Muthén & Muthén, 2007) to assess goodness of fit based on the following recommendations: root mean square error of approximation (RMSEA):  $\leq .06$ – $.08$ ; comparative fit index (CFI) and Tucker–Lewis Index (TLI):  $\geq 0.95$ , as well as standardized root mean residual (SRMR): close to 1 (Bentler, 1990). Finally, we conducted path analysis to estimate the proposed and alternative models. The strength and significance of indirect effects were assessed with a nonparametric bootstrapping



**Table 3.** Bivariate correlations: Ukrainian study.

	1	2	3	4	5	6	7	<i>M</i>	<i>SD</i>
1. Bioweapon coronavirus conspiracy beliefs	1	.58***	-.15***	.12**	-.05	-.11**	.08	2.67	1.02
2. Profit coronavirus conspiracy beliefs		1	-.30***	.23***	.19***	-.30***	.23***	1.78	0.81
3. Trust in epidemiological science			1	-.21***	-.13**	.19***	-.21***	4.05	0.84
4. Public risk metaperception				1	.31***	-.28***	.31***	2.52	1.24
5. Individual risk perception					1	-.35***	.27***	2.38	1.30
6. Preventive physical distancing						1	-.38***	3.91	0.91
7. Public gatherings							1	2.62	1.27

Note. \*\**p* < .01. \*\*\**p* < .001.

**Table 4.** Bivariate correlations: Turkish and German studies.

	1	2	3	4	5	6	Turkey		Germany	
							<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Variables										
1. Coronavirus conspiracy beliefs	–	-.09	.33***	.03	-.16**	.09	1.87	0.84	1.52	0.62
2. Trust in epidemiological science	-.38***	–	-.10	-.10	.17**	.00	4.41	0.80	4.31	0.90
3. Public risk metaperception	.29***	-.33***	–	.18***	-.35***	.20***	2.21	1.02	2.23	0.99
4. Individual risk perception	.25***	-.38***	.42***	–	-.20***	.20***	2.83	1.10	2.15	1.14
5. Preventive physical distancing	-.33***	.51***	-.44***	-.53***	–	-.43***	3.98	0.79	3.77	0.99
6. Public gatherings	.22***	-.39***	.40***	.44***	-.63***	–	1.95	0.99	2.36	1.21

Note. Correlations from the Turkish study are above the diagonal, and correlations from the German study are below the diagonal.

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

method using 500 resamples, allowing unbiased estimation of these effects.

*Descriptive Statistics and Intercorrelations*

Descriptive statistics are reported in Tables 3–4. In the Ukrainian sample, COVID-19 bioweapon and COVID-19 profit conspiracy beliefs were highly positively correlated. As expected, bioweapon beliefs were found to be negatively significantly correlated with trust in science and preventive physical distancing, as well as positively significantly correlated with optimistically biased public risk metaperceptions, but not with individual risk

perceptions. Profit beliefs were found to be negatively significantly correlated with trust in science and preventive physical distancing, as well as positively significantly correlated with both types of optimistically biased risk metaperceptions.

In the Turkish sample, coronavirus conspiracy beliefs were not significantly associated with trust in science and individual risk perceptions. However, conspiracy beliefs were associated with higher scores on optimistically biased public risk metaperceptions and lower scores on preventive physical distancing. The correlation between coronavirus conspiracy beliefs and public gatherings was nonsignificant.

In the German sample, the correlation matrix displayed a different pattern: all zero-order correlations were associated in the expected direction. In particular, coronavirus conspiracy beliefs were negatively associated with trust in science and preventive physical distancing, as well as positively correlated with both types of optimistically biased risk perceptions and intentions to engage in public gatherings.

### *Measurement Equivalence Across National Contexts*

Because the model consisted of three observed variables and three latent variables, we tested whether the study's two latent constructs with multiple indicator items—coronavirus conspiracy beliefs and preventive physical distancing—were invariant across contexts. To test the invariance of the scale measuring coronavirus conspiracy beliefs, we used the set of seven items that were used across all studies. Following a step-wise procedure, we first established the configural invariance model, and then we compared the metric invariance model and the scalar invariance model with the less restrictive model (Cheung & Rensvold, 2002; Milfont & Fischer, 2010). The results revealed that conspiracy beliefs and preventive physical distancing demonstrated metric noninvariance (unequal factor loadings), suggesting that cross-cultural comparisons cannot be adequately made (see Tables S1–S3, online supplemental material); therefore, we refrain from reporting the direct mean-level comparisons of the results and report the test of hypotheses for each sample.

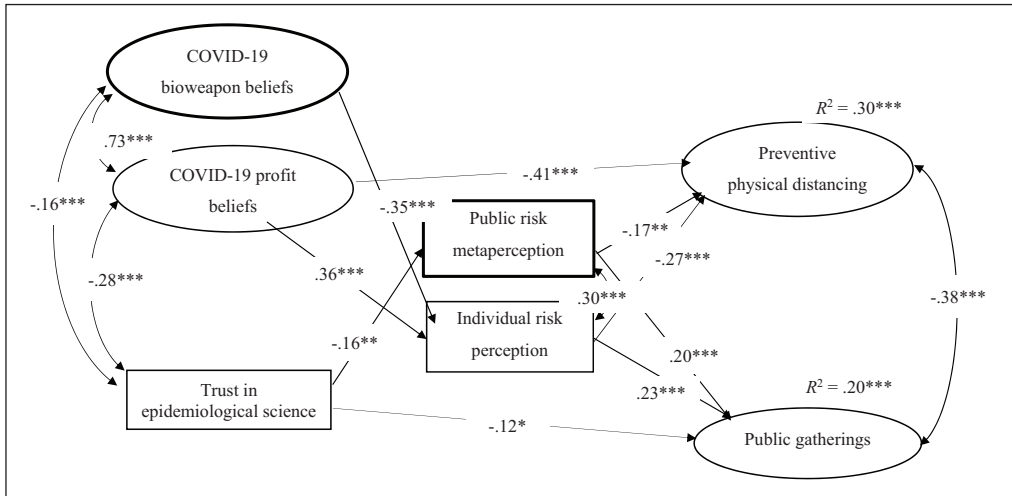
### *Measurement Model per Country*

In Ukraine, the factor measurement model had four latent (bioweapon conspiracy beliefs, profit conspiracy beliefs, preventive physical distancing, and public gathering) and three observed (trust in epidemiological science, public risk metaperception, and individual risk perception) indicators. High error terms between the items measuring coronavirus conspiracy beliefs were observed and allowed to correlate. The complete measurement model obtained an acceptable fit,  $\chi^2(97, N$

$= 390) = 219.09, p < .001, CFI = .94, TLI = .92, RMSEA = .06, SRMR = .05$ . The beta coefficients ( $\lambda$ ) ranged between .50 and .94, all of which were statistically significant ( $p < .001$ ), suggesting that the latent indicators used adequately measured the corresponding concepts. The complete measurement model (depicted in Figure 1) obtained an acceptable fit in both Turkey,  $\chi^2(92, N = 290) = 143.83, p < .001, CFI = .97, TLI = .96, RMSEA = .04, SRMR = .04$ ; and Germany,  $\chi^2(86, N = 408) = 220.62, p < .001, CFI = .95, TLI = .93, RMSEA = .06, SRMR = .06$ .

### *Hypothesis Testing per Country*

In the Ukrainian sample, the results of path analysis indicated that believing that the SARS-CoV-2 was a human-made bioweapon was positively indirectly associated with preventive physical distancing through optimistically biased individual risk perceptions (specific indirect effect:  $\beta = .09, p = .012$ ; 95% CI [0.02, 0.17]; total effect:  $\beta = .29, p = .023$ ; 95% CI [0.02, 0.55]). The path from COVID-19 bioweapon conspiracy beliefs to preventive physical distancing through optimistically biased public risk metaperceptions was found to be nonsignificant ( $\beta = .01, p = .773$ ; 95% CI [-0.03, 0.04]). Bioweapon beliefs were found to be negatively related to public gatherings directly ( $\beta = -.41, p = .001$ ; 95% CI [0.67, -0.16]) and indirectly only through optimistically biased individual risk perceptions ( $\beta = .08, p = .022$ ; 95% CI [-0.15, -0.01]). COVID-19 profit conspiracy beliefs were found to be indirectly associated with higher intentions to engage in public gatherings ( $\beta = .08, p = .008$ ; 95% CI [0.01, 0.15]) and less intentions to engage in preventive physical distancing ( $\beta = -.10, p = .010$ ; 95% CI [-0.17, -0.02]) through participants' optimistically biased individual risk perceptions. The direct and indirect effects of respondents' trust in science on preventive physical distancing were found to be nonsignificant; however, consistent with our prediction, trust in science was found to be negatively directly related to intentions to engage in public gatherings ( $\beta = -.12, p = .04$ ). Path estimates are presented in Figure 2.

**Figure 2.** Results of path analysis conducted with Mplus (Ukraine,  $N = 390$ ).

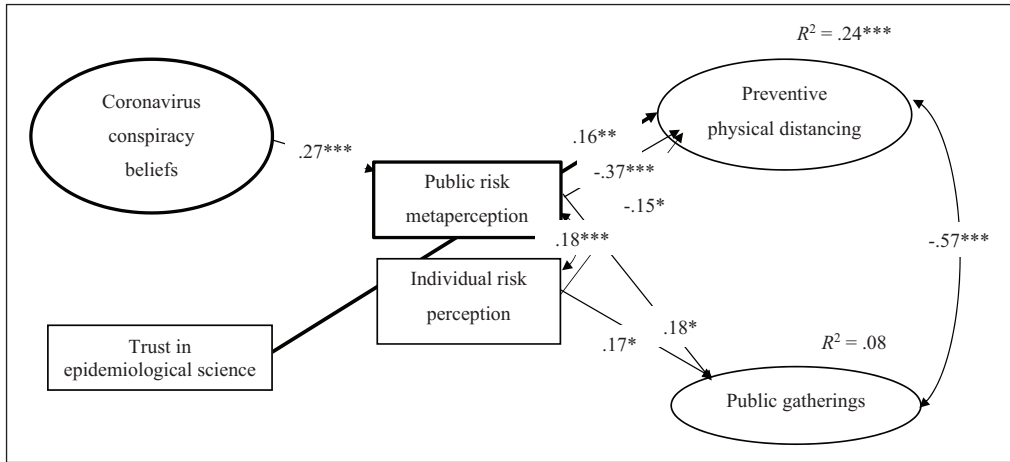
Note. Path coefficients are standardized estimates. Only significant ( $p < .05$ ) paths are depicted.

In the Turkish sample (for path estimates, see Figure 3), the results of path analysis indicated that coronavirus conspiracy beliefs were significantly positively associated with optimistically biased public risk metaperceptions ( $\beta = .38, p < .001$ ), which in turn were negatively related to willingness to engage in preventive physical distancing ( $\beta = -.37, p = .001$ ), suggesting the occurrence of an indirect effect ( $\beta = -.14, p = .001$ ; 95% CI  $[-0.20, -0.07]$ ); total effect:  $\beta = -.19, p = .015$ ; 95% CI  $[-0.35, -0.04]$ . The indirect path from coronavirus conspiracy beliefs to preventive physical distancing through individual risk perceptions was found to be non-significant ( $\beta = -.00, p = .755$ ; 95% CI  $[-0.02, 0.08]$ ). Contrary to our prediction, neither direct ( $\beta = .12, p = .149$ ; 95% CI  $[-0.04, 0.30]$ ) nor indirect ( $\beta = .07, p = .059$ ; 95% CI  $[-0.00, 0.14]$ ) effects of respondents' coronavirus conspiracy beliefs on public gatherings were observed. Trust in science was found to be directly positively associated with preventive physical distancing ( $\beta = .16, p = .02$ ).

In the German sample (for path estimates, see Figure 4), the results indicated that coronavirus conspiracy beliefs were positively related

to optimistically biased risk perceptions at both individual ( $\beta = .12, p = .026$ ) and group levels ( $\beta = .19, p < .001$ ). Consistent with our prediction, respondents' intention to engage in preventive physical distancing was predicted by their underestimated perception of the risk of getting infected ( $\beta = -.37, p < .001$ ) and their exaggerated public risk metaperception ( $\beta = -.20, p < .001$ ). As expected, optimistically biased individual-level risk perceptions ( $\beta = .29, p < .001$ ) and group-level risk metaperceptions ( $\beta = .24, p < .001$ ) predicted respondents' intentions to attend public gatherings. In contrast to Study 1, the indirect path from coronavirus conspiracy beliefs to preventive physical distancing ( $\beta = -.04, p = .015$ ; 95% CI  $[-0.07, -0.01]$ ) and intention to engage in public gatherings ( $\beta = .04, p = .019$ ; 95% CI  $[0.01, 0.10]$ ) was found to be mediated only by optimistically biased risk perceptions at the group level, albeit the indirect effect was found to be small in size (see Cumming, 2014). Trust in science was associated with higher willingness to engage in preventive physical distancing ( $\beta = .33, p < .001$ ) and less willingness to attend public gatherings ( $\beta = -.24, p < .001$ ), directly and indirectly through optimistically biased risk

**Figure 3.** Results of path analysis conducted with Mplus (Turkey,  $N = 290$ ).



Note. Path coefficients are standardized estimates. Only significant ( $p < .05$ ) paths are depicted.

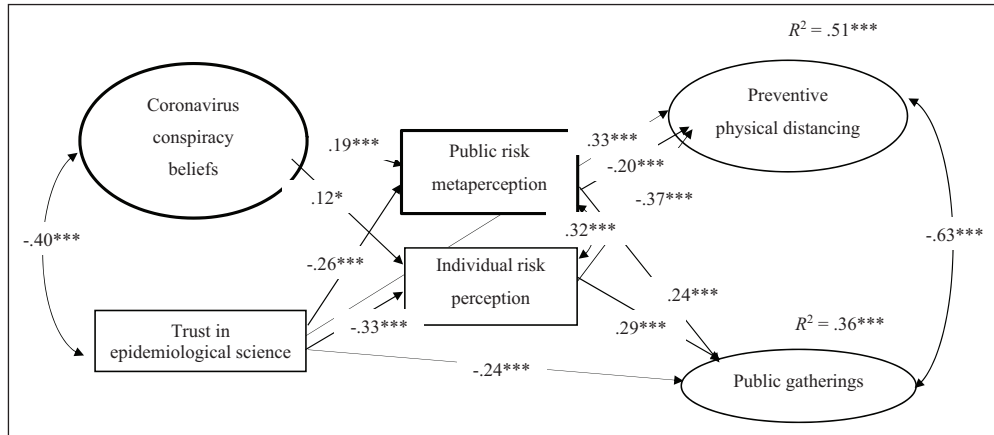
perceptions at both individual and group levels, suggesting the occurrence of mediation for preventive physical distancing (standardized indirect effect:  $\beta = .18, p = .001$ ; 95% CI [0.12, 0.24]; total effect:  $\beta = .50, p < .001$ ; 95% CI [0.39, 0.61]) and for intention to attend public gatherings (standardized indirect effect:  $\beta = -.16, p = .001$ ; 95% CI [-0.22, -0.10]; total effect:  $\beta = -.40, p = .001$ ; 95% CI [-0.57, -0.28]). All indirect path estimates are reported in Tables S4–S6 in the online supplemental material.

*Alternative Model Testing per Country*

In Ukraine, the results of the alternative model revealed that the indirect effects of bioweapon and profit coronavirus conspiracy beliefs as well as those of trust in science on willingness to engage in preventive physical distancing and attending public gatherings through the sequential mediation effects of public risk metaperceptions and individual risk perceptions were nonsignificant (for indirect path estimates, see Table S7 in the online supplemental material). In both Turkey and Germany, the results of the alternative model revealed that the indirect effects of coronavirus conspiracy beliefs on the two

types of behaviour through the sequential mediation effects of public risk metaperceptions and individual risk perceptions were nonsignificant. The indirect effects of trust in science on both types of behaviour sequentially mediated by public risk metaperceptions and individual risk perceptions were significant in Germany but not in Turkey (see Tables S8–S9 in the online supplemental material). Therefore, we consider our hypothesized model to be superior to the alternative model from a theoretical and an empirical perspective. Given the identical chi-square distribution and degrees of freedom of both the hypothesized and the alternative models, a further comparison cannot be made.

In summary, while in Ukraine conspiracy beliefs represented a two-factor solution, the results of the data collected in Turkey and Germany showed that a similar set of conspiracy beliefs had a unidimensional factor solution, suggesting the prevalence of a general conspiracy mindset in the lockdown context. The results of the measurement invariance tests revealed that coronavirus conspiracy beliefs as well as preventive physical distancing had noninvariant metric loadings across the three studies, thus not allowing for cross-cultural comparisons. Further,

**Figure 4.** Results of path analysis conducted with Mplus (Germany,  $N = 408$ ).

Note. Path coefficients are standardized estimates. Only significant ( $p < .05$ ) paths are depicted.

consistent with our prediction, conspiracy beliefs were found to be highly negatively correlated with trust in science (e.g., Lewandowsky et al., 2013; van der Linden, 2015) and negatively indirectly associated with preventive physical distancing in all the study contexts. In relation to the mediators, in Ukraine, both bioweapon and profit conspiracy beliefs were found to predict risky health behaviours through individual risk misperceptions, whereas in both Turkey and Germany the indirect paths were explained uniquely by optimistically biased public risk metaperceptions (e.g., Dryhurst et al., 2020; Williams et al., 2010). Finally, our hypothesis regarding the role of distrust of science in predicting risky health behaviour was partially confirmed: we observed its direct negative association with public gatherings in Ukraine, its direct positive association with preventive physical distancing in Turkey, and both direct and indirect associations through optimistic public risk metaperceptions in Germany.

## Discussion

A growing body of research has demonstrated that people's optimistically biased subjective appraisals of the risks posed by infectious diseases can cause their noncompliance with

preventive and mitigating measures in the public health domain (e.g., Dillard et al., 2009; Shepperd et al., 2013). In the current contribution, we examined the extent to which this kind of appraisals at both individual and group levels were likely to mediate the effects of COVID-19 conspiracy beliefs and distrust of science on individuals' intentions to engage in risky health behaviour amid locally imposed lockdown measures (e.g., Earnshaw et al., 2019; Freeman et al., 2020; Imhoff & Lamberty, 2020). Given the general replication crisis in psychology as a scientific field (Open Science Collaboration, 2012) and the WEIRD samples problem (Henrich et al., 2010), we aimed to diversify our sampling and to test our hypotheses in three different national contexts in Europe. Four crucial messages can be derived from our research.

First, our results revealed that the scale assessing participants' coronavirus conspiracy beliefs was noninvariant across contexts, suggesting that this new construct in social psychological research deserves a more detailed exploration to reveal what it entails, what its corollaries are within a specific cultural context, and whether it can be measured cross-culturally. A few scholars have started to study this psychological concept mostly in WEIRD societies to lay bare its elements,

pointing to the prevalence of “hoax” and “bioweapon” conspiracy ecosystems (Freeman et al., 2020; Imhoff & Lamberty, 2020). Our research contributes to the literature by providing empirical data from both WEIRD and non-WEIRD contexts and showing the need for more fine-grained measures. Critically, we also found that the scale assessing the emergent concept of preventive physical distancing had very different factor loadings across the study’s contexts. These findings speak to the important relationship between culture and preventive health behaviour. They also call for a contextualized qualitative and quantitative social psychological research on the meaning of preventive physical distancing, the perceived differences between “physical” and “social” types of distancing, as well as the naturally occurring cultural differences in people’s willingness to engage in activities aimed at restricting psychical direct contact. Our findings highlight the idea that contextualized and culturally aware social psychological research is critical to the development of adaptive, effective, and equitable health care policies.

Second, consistent with previous studies, our research provides clear evidence that conspiracy beliefs are positively associated with risky behavioural intentions in the context of emergent infectious diseases (e.g., Freeman et al., 2020; Imhoff & Lamberty, 2020). It also highlights the idea that the construct of coronavirus conspiracy beliefs has to be further scrutinized in terms of its dimensionality and potentially dissimilar matrix across different national contexts. In particular, future research should examine who is believed to be the protagonist behind the nefarious intents—Big Pharma, Zionists, the “New World Order,” etc. (as it has been notoriously discussed in global social media)—and most importantly, why and how such conspiracy ecosystems arise and prevail. In terms of the construct’s dimensionality, future research should also explore whether individuals’ beliefs about the origin of the virus as well as the transparency of state-level emergency procurement can have different hindering or facilitative effects on people’s public health behaviour. Advancing a theoretical understanding of highly and globally

endorsed coronavirus conspiracies should involve controlled experimental studies, cross-cultural studies, and other creative analytic techniques needed to elucidate the nature and consequences of such beliefs locally and across national contexts. From a practical perspective, such knowledge is crucially needed for the development of tailored strategies to raise public awareness and to effectively dismantle targeted conspiracy theories with timely fact-checking campaigns (e.g., Roozenbeek et al., 2020; van Bavel et al., 2020).

Third, consistent with literature on the role of risk misperceptions in predicting risky health behaviours (Dillard et al., 2009; Radcliffe & Klein, 2002), especially during pandemics (Dryhurst et al., 2020; Earnshaw et al., 2019), our hypotheses regarding the optimistic bias in risk perceptions and its associations with behavioural intentions to attend public gatherings amid lockdown measures were confirmed. However, on closer inspection, the revealed pattern of the mediation suggested that coronavirus conspiracy beliefs were likely to hinder health-protective behavioural intentions in a different way depending on who was the subject of risk misperceptions—self versus others. While Ukrainian participants’ optimistic perceptions of their own risk of getting infected with the SARS-CoV-2 were found to mediate the effects of both bioweapon and profit conspiracy beliefs on preventive physical distancing and intention to engage in public gatherings, the results of the studies in Turkey and Germany revealed unique indirect effects of optimistically biased public risk metaperceptions but not of individual perceptions. A plausible explanation of these differing results can be that risk perceptions generally depend on numerous contextual factors such as cultural differences in media coverage of health emergency events (e.g., Reyna et al., 2009; Wahlberg & Sjöberg, 2000), and sociodemographic variables such as domain-specific direct personal experiences (e.g., Ferrer & Klein, 2015; van der Linden, 2014). The results of the alternative model pointed at a possible causal ordering of the two types of risk perceptions, suggesting that the formation of individual risk perceptions can depend on how people perceive others’ risk evaluations. However, an important limitation of our research is

its cross-sectional nature; therefore, future controlled experimental studies should examine these causal effects in more detail and scrutinize other contributing factors of risk misperceptions to help develop measures aimed at limiting pandemics' impact on public health.

Last, we observed a counterintuitive pattern of indirect effects of individuals' trust in epidemiological science on public health behavioural intentions. Although our hypotheses were supported by the data from Germany (the only WEIRD context among those under the current examination, with 50.2% of the total sample), we failed to provide empirical evidence for the effects of trust in science on behavioural intentions using the cross-sectional data from Ukraine and Turkey (except for its revealed direct negative effect on intention to engage in public gatherings in Ukraine and positive effect on preventive physical distancing in Turkey). We acknowledge that there can be various contextual, psychological, and methodological factors behind these observed nonsignificant indirect effects. For instance, previous research has shown that scientific recommendations may be rejected (Lewandowsky et al., 2013; van der Linden, 2015), particular conspiracy theories may be endorsed (e.g., Chayinska & Minescu, 2018), and risk perceptions (e.g., Cruwys et al., 2020) may be biased because science can be in conflict with individuals' ideological or religious opinions and opinion-based shared social identities. Future research should therefore examine whether conspiracy thinking, distrust of science, as well as risky health behaviours are likely to be determined by the effects of strong versus weak salient social identities. Furthermore, the inconsistency in the observed effects can also be due to the chosen single-item measure, (the measure was, however, validated in the context of the COVID-19 pandemic). It is therefore crucial for future research to consider other markers and possible dimensions of the construct of trust in epidemiological science, including trust in scientists' competence, transparency, and the accuracy of information they provide (e.g., Funk et al., 2019). Replications of the study with a few methodological changes,

including scales designed to measure multidimensional constructs, are required to confirm whether higher trust in science can potentially mitigate risky health behaviours driven by optimistically biased risk perceptions.

Taken together, these findings from the non-WEIRD Ukrainian and Turkish samples as well as from the WEIRD German sample highlight the importance of taking the social, cultural, and political context into consideration when trying to understand individuals' public health behaviour. Although our research points to the potentially hindering effects of optimistic risk perceptions on people's willingness to follow public health orders, future research should unpack the impact of cultural and individual differences in levels of individualism versus collectivism, democracy versus authoritarianism, trust in public authorities, and the freedom of media on individuals' safety-related behaviour in the context of emergent infectious diseases. This should help in the development of appropriate country-specific prevention strategies.

In conclusion, the current contribution illustrates the potency of COVID-19 conspiracy beliefs in predicting optimistically biased risk perceptions and undesirable societal consequences for the public health domain. Confronting the transmission of a fast-moving pandemic presents a challenge that can seemingly be solved by collective joint efforts, diversified strategies, and local community-driven solutions. We hope that the current contribution helps scientists and policymakers understand the complex and context-dependent role of incremental individual- and group-level processes through which individuals' problematic behaviour (i.e., non-compliance with locally imposed mitigation measures) can be effectively confronted.

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## Supplemental material

Supplemental material for this article is available online ([https://osf.io/3ndzy/?view\\_only=ed5534c4238c4616803dbcf55321d5a4](https://osf.io/3ndzy/?view_only=ed5534c4238c4616803dbcf55321d5a4)).

## Notes

1. We also collected responses on several other measures of perceived injustice and anti-lockdown collective action intentions unrelated to the current paper (i.e., as a basis for new lines of research).
2. The item “The coronavirus was created by China to destroy the West’s economies” was not included in the scale because this conspiracy theory had arguably been less pronounced in local public discourses in Turkey and Germany.

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